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THIRTY-SECOND MEETING OF THE AMERICAN ASTRONOMICAL SOCIETY.

The thirty-second meeting of the Society was held on the invitation of Professor John M. Poor, at Dartmouth College, Hanover, New Hampshire, from August 3 to 6, 1924. The date had been fixed immediately before the meeting of the British Association for the Advancement of Science at Toronto, and the Society was glad to welcome several astronomers from England and France who stopped over at Dartmouth.

The members lived together in the beautiful college surroundings which made so much for convenience and pleasure at the meeting. As an innovation the opening was on Sunday, and members began to arrive even the night before. Some, however, were surprised by the New England sabbath and found a scarcity of local Sunday trains. One high officer of the Society coming from a great distance found himself stranded nearly a hundred miles away, but he requisitioned the present universal means of locomotion and arrived in time for the first scheduled event. Two other prominent members, finding no train at their connection, started to walk some forty miles, but after proceeding a few hundred yards on the main highway they hailed a passing vehicle and were given a lift to within sight of the college, where they arrived footsore and weary but with a fine appreciation of New England hospitality.

On Sunday afternoon the members gathered at the Mel Adams Cabin, maintained by the Dartmouth Outing Club, on one of the hills overlooking Hanover, and were entertained with a picnic supper. Some of the ardent spirits, including the English guests, had climbed to the highest point in the immediate neighborhood to make sure of the best view.

On Monday there were the usual morning and afternoon sessions for papers. In the evening there was a charming entertainment by Professor Leland Griggs of Dartmouth, who exhibited some intimate pictures and descriptions of the animal inhabitants of the neighborhood.

On Tuesday the Society for the first time was privileged to hear from a newly elected honorary member. Professor A. S. Eddington, director of the Cambridge Observatory, was present and addressed the Society on his latest researches on the source of stellar energy.

Between sessions the visitors did not neglect to investigate the environs of the college, which abound in beautiful walks; and on Tuesday evening another season was vividly depicted by motion pictures of Dartmouth winter sports.

On Wednesday morning a short final session was held before the members departed, some who were traveling in automobiles continuing their tours through the White Mountains or elsewhere, while a good contingent went to Toronto for the British Association.

At the last session there were elected as officers those whose terms in the following list begin in 1924, others continue to serve unexpired terms:

President	W. W. Campbell	1922-1925
Vice-Presidents	Ernest W. Brown	1923-1925
	Heber D. Curtis	1924-1926
Secretary	Joel Stebbins	1924-1925
Treasurer	Benjamin Boss	1924-1925
Councilors	John M. Poor	1922-1925
	Chas. E. St. John	1922-1925
	Anne S. Young	1923-1926
	C. A. Chant	1924-1926
	W. J. Hussey	1924-1927
	Harlow Shapley	1924-1927
Ex-President	Frank Schlesinger	

Members of the Division of Physical Sciences, National Research Council:

Edwin B. Frost	1922-1925
Ernest W. Brown	1923-1926
Harlow Shapley	1924-1927
Joel Stebbins	1925-1928

The following persons were elected to membership, making a total of four hundred and eleven in the Society:

Arthur W. Butler, Mt. Kisco, N. Y.
Morgan Cilley, 220 West 19th Street, New York City.
Charles W. Elmer, 15 Park Row, New York City.
Foy N. Hibbard, U. S. Weather Bureau, Duluth, Minn.
R. R. Holmes, 458 West 61st Street, Chicago, Ill.
Dean B. McLaughlin, Detroit Observatory, Ann Arbor, Mich.
Carlos S. Mundt, State Teachers and Junior College, Fresno, Calif.
Cecilia H. Payne, Harvard College Observatory, Cambridge, Mass.
Helen Whitaker, Washburn College, Topeka, Kansas.
William Braid White, 5149 Agatite Avenue, Chicago, Ill.

Members of the Society and foreign astronomers present at the Dartmouth meeting were:

R. G. Aitken	W. W. Campbell	C. T. Elvey
S. Albrecht	Annie J. Cannon	Alice H. Farnsworth
H. L. Alden	G. C. Comstock	P. Fox
S. I. Bailey	C. H. Currier	Caroline E. Furness
Ida Barney	H. D. Curtis	N. E. Gilbert
Harriet W. Bigelow	H. S. Davis	C. C. Godfrey
B. Boss	A. S. Eddington	A. Hall
E. W. Brown	W. S. Eichelberger	W. M. Hamilton
Leon Campbell	C. W. Elmer	J. C. Hammond

W. E. Harper
J. Hartness
Margaret Harwood
J. Jackson
H. Jeffreys
E. S. King
O J. Lee
C. A. R. Lundin
W. J. Luyten
D. B. McLaughlin
J. Mascart
Antonia C. Maury
W. I. Milham
J. A. Miller
G. F. Paddock
J. Pawling
Cecilia H. Payne
C. D. Perrine
G. H. Peters
H. C. Plummer
C. L. Poor
J. M. Poor
F. E. Ross
A. J. Roy
H. N. Russell
F. H. Safford
C. E. St. John
F. Schlesinger
H. Shapley
T. M. Simpson
B. W. Sitterly
Lois Slocum
C. L. Stearns
Mrs. C. L. Stearns
J. Stebbins
H. T. Stetson
J. Stokley
Helen Swartz
J. Tatlock
I. Yamamoto
Anne S. Young

It was announced that meetings of the Society had been fixed by the Council as follows: 1924 December, at Washington; 1925 September, at Carleton College, Northfield, Minnesota; 1926 December, at Philadelphia.

REPORTS OF COMMITTEES

REPORT OF THE COMMITTEE ON ECLIPSES

Since the time when photography was first applied to the study of eclipses the entire duration granted to astronomers for securing observations during the total phases of various eclipses has amounted to about one hour. It is not surprising, therefore, that there are many astrophysical problems still awaiting solution.

Unfortunately, the solar eclipse of January 24, 1925, does not promise good observing conditions. Totality occurs early on a winter's morning, with the altitude of the sun not more than 20°. The chance of clear skies less than fifty per cent and the difficulties of erecting and adjusting delicate apparatus at a temporary site under inclement conditions, will make a combination tended to discourage any but the most enthusiastic of eclipse observers. It is safe to say that few professional astronomers living at a distance will be attracted to the eclipse path for the purpose of making observations with an extensive instrumental equipment.

Fortunately, there are several observatories lying in the path of totality. These are: Vassar at Poughkeepsie; Van Vleck at Middletown; Yale at New Haven; and Maria Mitchell at Nantucket. In addition to these four, there are many other observatories, but they are not equipped for photographic work. And, also, there are many telescopes of small and moderate aperture belonging mainly to amateur astronomers.

In view of the small promise of success a brief summary only will be given here of the chief astrophysical problems awaiting solution from eclipse observations.

1. *The Einstein Problem.*

The very accurate measures by Campbell and Trumpler of the 1922 eclipse plates of the Lick Observatory have furnished an excellent confirmation of the Einstein deflection at the edge of the sun. The photographs with the telescope of fifteen feet focus gave an observed deflection of 1″.72, in splendid agreement with the predicted value of 1″.75. The plates of five feet focus, covering a larger area in the sky and including many more stars, confirm the results of the plates of longer focus. During the past year both Evershed and St. John (the most competent authorities in the world) independently have found the Einstein deflection towards the red in the solar spectrum. Another very competent worker, Burns of Allegheny, does not agree with the conclusions of Evershed and St. John. A determination of the exact wave-length of a line in the solar spectrum is a very complicated problem. It is difficult to eliminate or allow for all possible causes of deflection so as to say that the final result is positive indication of an Einstein deflection. Suffice it to say, however, that at the 1925 eclipse it will certainly not be worth while to attempt any Einstein photographs.

2. *Photography of the Corona.*

This will always remain one of the most important problems connected with an eclipse. Such photographs are specially important at the 1925 eclipse. As Campbell has pointed out, in the whole history of eclipse work not a single photograph of the corona has been obtained with the sun slightly past the minimum of spots and on the up grade towards maximum. The eclipses of 1922 and 1923 showed the minimum types of corona (with some variations) of long equatorial streamers and strong polar brushes. What will be the form of the 1925 corona? How much will it have changed from the minimum type towards that of maximum of spots when the corona is star-like in form resembling a gigantic dahlia?

This is a problem in which the amateur as well as the professional astronomer can assist by making long exposure photographs with cameras of various focal lengths. The faster the camera (the greater the ratio of aperture to focal length) the better, and the faster the plates the better. The diameter of the sun on the photographic negative is roughly one-hundredth part of the focal length of the lens, or more nearly one-ninth of an inch per foot of focal length. Great care must be exercised in the development of the negatives, and attempts should be made to secure as much of soft detail as possible by the use of such an old-fashioned developer as pyro (or similar developers) rather than to try for hard and contrasty effects.

At the eclipse of 1923, Miller of Swarthmore detected a disturbed region of the corona in the neighborhood of a spot near the edge of the sun. The same has been seen at previous eclipses. What connec-

tion is there between the corona and other solar features, such as spots, prominences, faculae, etc.? What is the speed of changes taking place in the corona? What force or forces are at work to form the corona? What information can recent knowledge regarding atomic structure and ionization bring to this question? These and many other problems still await solution.

3. *The Spectrum of the Corona.*

There are many questions connected with the coronal spectrum still to be solved. The answers, however, can only come from trained astronomers using refined and well-standardized spectrographs capable of affording as exact wave-lengths as possible. It is only by the securing of such photographs which can be compared with similar photographs at previous eclipses that any advance in knowledge will be obtained. Does the corona rotate? And if so, how? We have no positive information as yet. What makes the corona radiate light? What part of it shines by reflected sunlight and what is inherent in the coronal gas or gases? The corona has been traced to the enormous distance of ten million miles from the sun's surface. How is radiation possible under these conditions? Owing to the paucity of time available for observations we know little of the coronal spectrum. It was not until the eclipse of 1898 that the green coronium line at λ5303 was distinguished from the 1474-line at λ5317. At the eclipse of 1918 the wave-length determinations of this, the strongest line of the coronal spectrum, by Lick and Mount Wilson Observatories differed very radically. Until we can secure more, and excellent photographs of the spectrum of the corona, it is foolish to talk of solving any of these important problems.

4. *The Spectrum of the Chromosphere.*

At the beginning and ending of totality, the flash spectrum can be seen and photographed. The photographs can be secured either with prism or grating spectrographs, and either with or without slit. The following is quoted from the report of the Committee on Eclipses presented to the American Section of the International Astronomical Union in 1922. "Photographs of the flash spectrum have added immensely to our knowledge of the sun's reversing layer. Although the flash spectrum has been successfully photographed without an eclipse by Hale and Adams, and higher dispersion was employed by them than is practicable to use at the time of an eclipse, yet the desirability of continuing the eclipse observations with good and powerful equipment still exists. It is very important that the thickness and relative heights of the gaseous and vapor strata comprising the solar atmosphere should be accurately determined on many occasions, and these data can apparently be found in no other manner so satisfactorily as by photographing the flash spectrum without the use of slit at total eclipses. The

best form of apparatus appears to be the concave grating and coelostat.

"It is also recommended that the flash spectrum be recorded on a plate moving continuously in a direction parallel to the tangent at the central point of the reversing-layer crescent, only the light from a short central section of this crescent being permitted to fall upon the plate. This method has the great advantage that the changes occurring continuously as the reversing layer is gradually covered at contact II and uncovered at contact III will be recorded. Further, there is no appreciable uncertainty as to the proper times for making the exposures, such as exists when using the method described in the preceding paragraph. However, there is the disadvantage that a depression or elevation in the moon's limb, or the presence of a prominence on the sun's limb at the mid-point of the reversing layer crescent, may affect the record with some uncertainty."

Near the edge of the path of totality the moon is nearly tangent to the edge of the sun with the consequence that the chromosphere is covered and uncovered near one of the poles of the sun. At the middle of the eclipse track the flash spectrum is visible near the sun's equator at two regions 180° apart at beginning and end of totality. Photographs taken near the edge of the moon's shadow path would furnish exposures of the flash spectrum relatively longer than from a location near the central line. For purposes of comparison, it would be desirable to secure photographs from both locations.

5. *Intensity of the Coronal Light at Various Distances from the Sun's Edge.*

Abbot with the bolometer and Stebbins with the photoelectric cell have measured the intensity of the corona at different distances and have compared their measures with similar measures made on the full moon and on the illuminated sky at different distances from the sun. Observations of polarized light, visually but preferably photographically, and photographs of the corona in light of different colors can aid in the investigation.

Although the information is very conflicting, the total light of the corona appears to be about three-quarters that of the full moon, or roughly one 800,000th part of that of the uneclipsed sun. Little is known of the law underlying the distribution of light in the corona at different distances from the sun. We have laws of the inverse square, inverse fourth, sixth, and eighth powers, but which is the best law is more than at present we know. Information on this subject will aid in our knowledge of what the corona is.

6. *Intra-Mercurial Planets.*

These objects, discovered (?) at the eclipse of 1878, have received much attention by astronomers. We know rather positively, the result

of observations of several eclipses, that if any such objects exist they must be very minute in size.

7. *Other Eclipse Problems.*

The Department of Terrestrial Magnetism of the Carnegie Institution of Washington at recent eclipses has made valuable observations on certain magnetic and electric phenomena connected with an eclipse. Fortunately for these observers it makes no difference whether the skies during totality are clear or cloudy, or whether the observer is even within the path of totality or not.

"Shadow bands" still continue to be interesting matters of observation at eclipses. It seems rather certain that these are meteorological, *i. e.*, caused by conditions in the earth's atmosphere, such as the direction of the wind.

The eclipse of 1925, coming as it does in the thickly populated region of the United States, will furnish an excellent opportunity of acquainting the thinking public with some knowledge of the work of the astronomer. The members of the Committee who have witnessed several eclipses, know from experience what great interest and excitement is caused by a total eclipse. For these reasons the various members of the Committee will stand ready to advise intending observers regarding their problems.

S. A. Mitchell, *Chairman.*
H. D. Curtis,
W. J. Humphreys,
J. A. Miller,
Frederick Slocum,
Joel Stebbins.

REPORT OF THE SUB-COMMITTEE ON MEASUREMENTS AND PUBLIC CO-OPERATION OF THE 1925 ECLIPSE.

This report deals with plans to secure positions of the moon for comparison with the tabular places, to obtain material for measurement of the projected lunar disc, and to obtain the coöperation of the public.

1. *Observations for the position of the moon.* Since at least six observatories are within the region of totality, the opportunity to obtain accurate times and positions of the moon during the partial and total phases appears to be one which should be utilized fully. The routine observations of the moon's position made by various national and other observatories suffer in general from the fact that good observations are not in general obtainable near new moon, so that short period deviations from the tabular places can be investigated from a portion of the monthly orbit only; an eclipse can furnish a position of high accuracy at new moon. In order to utilize such an observation to its fullest

extent, it is advisable to obtain observations at least during the months immediately preceding and following the eclipse. The committee proposes that observers be asked to obtain observations of the moon during this period.

Four methods for the determination of the moon's position are at present available. Meridian observations are made by a few national observatories as part of their regular routine; as long series of these are available and the various errors and corrections have been fully investigated, it is probably not advisable to attempt to supplement these from other institutions. A certain number of extra meridian observations has been made from time to time; it is proposed that a few of these should be secured if possible on nights when meridian observations are not obtainable. Occultations can be observed without the special equipment needed for the other methods and it is hoped that a considerable number of these may be made. A list of stars to be occulted during the period suggested is in preparation and will be published in time for use by observers. The photographic method as developed at Harvard and Princeton furnishes positions comparable in accuracy with the best meridian observations and, though the measurement and reduction of the plates is a somewhat lengthy process, they have the advantage of being obtainable at any time during the night when the moon is within some three hours of its meridian passage.

A by-product of such a campaign will be an investigation of the systematic errors to which the different classes of observations are subject by comparison of the results.

Photographs of the partially eclipsed sun with the instant of exposure can be utilized to furnish a position of the moon, provided the scale of the plate be secured by a given setting of the focus. These may be taken either within or outside the region of totality. It is to be remembered that in comparison with most stellar work the degree of accuracy expected in photographic measurements of the moon's position is very much lower, the nearest tenth of a second of arc being in general sufficient for the record.

Observations of the times of the beginning and end of totality should be made with all possible accuracy. Several photographs on the same plate slightly shifted with chronographic records may be of some interest if taken just before the beginning and just after the end of totality.

2. *Observations for the measurement of the moon's diameter.* Previous measures have been generally made on the disc of the moon reflecting the light of the sun. It appears to be of some interest to obtain such measures with the dark moon, utilizing the corona as a background. There are probably plates from other eclipses in existence which might serve this purpose but it is proposed that plates be taken during totality with such exposure times as shall furnish a lunar disc most suitable for accurate measurement. The lunar disc exhibits con-

siderable variation in diameter, not only those due to local variations in the height of the surface but also over districts comparable in area with the whole lunar surface.

3. *Information and coöperation of the public.* Plans are under way to give the public living within the region of totality information concerning the general features of the eclipse, so that they may know what features to expect and observe. It is hoped that arrangements may be made with the newspapers and the various wireless companies in order to disseminate this informaton in the most effective way. An effort will be made to obtain the stopping for a few minutes of all ordinary activities, so that every one shall have the opportunity to observe a phenomenon which in any one place occurs on the average only once in many hundred years.

It is hoped to utilize the same agencies to define with considerable accuracy the northern and southern limits, mainly by questions which any ordinarily intelligent person can answer correctly. Useful information may also be reasonably expected concerning the general appearance of the corona, the shadow bands if existent, prominences, and the amount and quality of the darkness during totality. Observations on any possible changes in "static" during the eclipse will also be asked for. Plans for the assembling and digestion of the information thus obtained are under consideration.

ERNEST W. BROWN, *Chairman.*
L. J. COMRIE,
W. S. EICHELBERGER,
H. N. RUSSELL.

ASTRONOMY AT THE BRITISH ASSOCIATION.

By C. A. CHANT.

Section A of the British Association is devoted to "Mathematical and Physical Science" which is interpreted to include Mathematics, Physics, Astronomy, Meteorology, and Seismology—an imposing set of subjects. At the recent meeting in Toronto there were forty-five numbers on the program, although there was not a single paper on pure mathematics.

A number of the papers were of very general interest and were presented to all the members of the section, but on several days there was a sub-section for "Cosmical Physics" especially for astronomy, meteorology and seismology. The meetings were largely attended and the discussions were often lively and joined in by many. On Saturday evening, August 9, there was a "Citizens' " lecture on "Relativity" by Professor A. S. Eddington in Convocation Hall, which was filled with

an audience of about 1,600. Professor Eddington by his lucid explanations and apt illustrations, often touched by dry humor, held his hearers for over an hour.

An outline of the astronomical papers and of some others closely related to them is given herewith.

A. S. Eddington.—*Theory of the Outflow of Radiation from a Star.*

The outward flow of radiation through a star depends on the temperature gradient (strictly the gradient of T^4) urging the flow, and on the absorption-coefficient or opacity resisting the flow. The temperature distribution is determined by the conditions (1) that it must be such as to maintain itself automatically, (2) that the resulting pressure must support the material against gravity. Very general considerations as to the processes involved in absorption indicate that the opacity will be approximately proportional to $\rho/T^{7/2}$. In this way formulae are obtained giving the total outflow of radiation from a star of given mass and density, provided that it is constituted of perfect gas; the total radiation depends mainly on the mass, the density making comparatively little difference. The observational data fit these formulae very closely. The surprising thing is that a great part of the density refers to stars of density greater than water; it is suggested that these stars agree with the theoretical results for a perfect gas because the atoms, being broken up by intense ionization, approximate closely to the ideal point-molecules of a perfect gas. The conclusions conflict with giant and dwarf theory of stellar evolution.

L. Silberstein.—*Determination of the Curvature Radius of Space-Time.*

Considering space-time as defined by de Sitter and that the observed star and the observer's station act as "free particles" in radial, purely inertial, motion, a formula is deduced for the complete Doppler effect or spectrum shift. This, when applied to eight globular clusters and the two Magellanic Clouds, gives an arithmetical mean of, Radius $= 6.7 \times 10^{12}$ astronomical units.

H. H. Plaskett.—*The Spectra of Nebulae.*

This paper discusses some new observations on the spectra of the nebulae. They furnish the absolute intensities of the hydrogen and some "nebulium" lines as determined by the wedge method in the Orion Nebula; partially confirm the previous interferometer results in assigning a low atomic weight to "nebulium"; and finally contain a complete description of the new gaseous envelope star Z Andromedae, discovered at Victoria. In the discussion these and the much more numerous earlier observations are treated in an attempt to determine (a) the mode of excitation of the nebular radiation, and (b) the nature of the carrier of the "nebulium" spectrum, in particular if it is a H He molecule.

J. Jackson.—*Photographic Proper Motions of Faint Stars.*

During the past year the Zone centered at 65° N. Decl. has been photographed with the 13-inch astrographic telescope at the Royal Observatory, Greenwich, for the determination of proper motions by comparison with the original astrographic plates taken about thirty years ago. The new plates are taken through the glass—*i. e.*, with the film side of the plate away from the object glass of the telescope. The new and old plates are then placed film to film and the relative position of the stars measured.

All the plates on this Zone have now been measured, so that it is possible to deduce the proper motion of all stars between 64° and 66° N. Decl. down to about the twelfth magnitude. Most proper motions of the order of 3″ a century can be detected with certainty. The following short table shows the number of stars found with a proper motion exceeding 5″ a century in the second half of the Zone, namely with R. A. 12^h to 24^h:

Centennial Proper Motion.

No. of Stars in Catalogue	5″- 10″	10″- 15″	15″- 20″	20″- 30″	30″- 50″	50″
10,192	533	87	38	20	10	1

The results are being discussed for systematic motion of the stars.

R. K. Young and W. E. Harper.—*Methods and Results of Spectroscopic Absolute Magnitude Determinations.*

The paper presents the results of an investigation into the methods of determining parallaxes by the spectroscopic method and gives results for 1,105 stars. The spectra of 500 stars of known parallax were used to calibrate the empirical curves relating line intensity to absolute magnitude; new lines showing the effect were found, and fourteen have been used in the work. A standard scale showing absorption lines of graded intensity was used in estimating line-ratios. Proper motions were used as a check upon the results of groups of stars. Substantial agreement exists with Mount Wilson results except in the late K-giants, where we have a greater range in brightness.

F. Henroteau.—*The System of σ Scorpii.*

As a result of several years study it appears probable that σ Scorpii is an interesting triple system. First it was found by Father Selga that a considerable variation of radial velocity existed, having a very short period (about six hours). The star is thus of the β Canis Majoris type, or as we have reason to suppose, an extreme case of Cepheid variation. The short-period radial velocity variation cannot be attributed to orbital motion.

A longer period of radial velocity variation (about 34 days) due to orbit motion was then discovered, long period curves being determined in the years 1918, 20, 21, 22, 23 and 24. Remarkable changes of shape

and amplitude occur in them. Theoretical researches made in 1921 indicate that large perturbations in the orbit could not be due to a possible non-spherical shape of the primary body.

At present we find indications of the existence of a more remote third body, that is of a motion in a longer period orbit (probably in the neighborhood of five years). This is found not from the variation of radial velocity, but from the fact that the maxima or minima of the short-period radial velocity curves come, in some years sooner, in other years later, than the predicted ones; in other words there is a very marked equation of light, which from its variation permits us to compute elements of the long period orbit.

σ Scorpii may thus be considered as a Cepheid in a triple system, a case unique at present, which from the fact that it shows remarkable perturbations may bid fair to throw important light on the problem of Cepheid variation.

R. Meldrum Stewart and J. P. Henderson.—*Wireless Time Signals.*

Wireless time signals are received at Ottawa on all possible occasions from Annapolis and Lafayette, giving systematic time comparisons between Ottawa, Washington and Paris. The period considered extends from April, 1921 (when the emission of vernier time signals was begun by Lafayette), to the end of 1923. The differences, Ottawa minus Washington and Ottawa minus Paris, run with remarkable smoothness from day to day, usually within .02 to .03 sec., but there is shown a gradual variation over longer periods reaching quite considerable proportions, sometimes of the order of .20 sec. From the lack of correspondence between the variations in O — W and O — P it is evident that the responsibility is divided between at least two of the observatories involved, and presumably among all three. One of the most outstanding facts is the occurrence of sharp breaks in the differences, four of these occurring in the series O — W and two in O — P; for one of these (Jan. 1, 1922) Ottawa appears to be responsible.

The individual differences were grouped into weekly means, and the means of these for the various periods are as follows:

	O — W	O — P
	s	s
1921, Apr. 15-May 21	+ .04	.00
May 22-Oct. 1	— .05	.00
Oct. 2-Dec. 31	+ .01	.00
1922, Jan. 1-Apr. 29	+ .05	+ .06
Apr. 30-Dec. 30	— .05	+ .05
1923, Jan. 0-Dec. 29	— .04	— .01

No correction has been applied for time of transmission; the difference O — W for 1923 has been corrected by .05 sec. to allow for the change in the Washington fundamental star system adopted Jan. 1, 1923. The average discordance of weekly means from period means is $\pm$.03 sec., the corresponding average total range being .16 sec. The

reality of the sharp breaks between periods is very evident; for example, of the 35 weekly means in the period 1922 April 30-Dec. 30, only one is positive for O — W, and only three negative for O — P; and similarly for the other periods.

Reception of signals is usually effected by the method of coincidence by extinction, which has been described elsewhere. Comparisons have been made between observations by this method and by that of actual chronographic registration; the latter were also studied independently. It appears that in the case of chronographic registration the greatest precautions must be taken to avoid the introduction of variable relay lags, especially differences in lag between the incoming signals and the artificially introduced clock signals. Apart from photographic methods, and possibly those involving the use of a syphon recorder, the only satisfactory method appears to be the use of a relay of speed comparable with that of the audio heterodyne beat pitch, coupled with another relay in such a way as to ensure the carrying through to the chronograph of even a single pulsation of the primary relay. Detailed measurements of accuracy show in either method errors of the order only of one hundredth of a second.

An actual record of signals, etc. may be obtained on smoked paper by using a stylus mounted on an arm attached to the diaphragm of a sensitive telephone receiver. This is especially suitable for studying the effect of different classes of circuits. It was shown that unstable circuits, such as those with parts almost on the point of audio or other oscillation and those with excessive feed-backs, were undesirable on account of the possibility of different times being required for these to "spill" and by their trigger action let loose the large amounts of energy that would operate the relays.

A. L. Cortie.—*The Relation between Solar Activity and Terrestrial Magnetic Disturbance.*

1. A sun-spot of very great area is always accompanied, at some stage of its life history, by a magnetic disturbance. For instance, in the solar cycle 1913-1924 just completed, the maximum sun-spot, 1917 August 11, was accompanied by a violent magnetic storm, as was also the great sun-spot group of 1920 March 22-24. But there is no parity between the size of a sun-spot and the character of the concomitant magnetic disturbance. Great activity is more effective than great area in sun-spots. An example is the very great magnetic storm of 1919 August 11-13, which accompanied a relatively small, but very active, spot, and the moderate magnetic disturbance which occurred when a very much greater sun-spot group was on the sun's disc, 1919 August 19.

2. The terrestrial magnetic disturbances are more numerous after the maximum phase of sun-spot activity in a cycle. From the numbers of moderate, great and very great disturbances, mean magnetic "char-

acter" figures have been derived, which are compared with the mean disc-areas of the sun-spots in the following table:

Year	Disc-area Spots	Magnetic Character	Year	Disc-area Spots	Magnetic Character
1912	0.20	0.05	1918	7.90	0.27
1913	0.04	0.06	1919	8.40	0.39
1914	0.82	0.07	1920	4.05	0.26
1915	4.51	0.12	1921	3.14	0.26
1916	4.52	0.20	1922	1.73	0.45
1917	12.10	0.14	1923	0.37	0.19

The phenomenon is apparent in the last three solar cycles. It is also brought out in the well-established 27-day period in terrestrial magnetic disturbance, which is much more developed with a low sun-spot frequency, and a low latitude of the spots. In individual storms of greater violence it is shown in those of 1920 March 22, and 1921 May 13-14.

3. Magnetic disturbances of considerable activity may occur at a period of solar calm, when there are no sun-spots, or even faculae, visible on the sun's disc. Examples in the last cycle are the disturbance of 1923 March 23-25, and of 1924 January 29-30. Such storms are connected with the synodic presentment to the earth of solar areas which had been previously disturbed by sun-spots. They remain intermittently effective, so far as their relation to terrestrial magnetism is concerned, even after the spots have disappeared.

H. H. KIMBALL.—*The Determination of Daylight Intensity from Automatic Records of Total Solar and Sky Radiation.*

Color temperatures of and spectrum energy curves of radiation from the sun and the sky, have been utilized to determine approximately the spectrum energy curve of the total radiation received on a horizontal surface, and its variation with atmospheric transmissibility and the solar zenith distance.

A comparison of these latter curves with the curve of "visibility of radiation" permits a prediction to be made of the variations to be expected in the ratio between the intensities of the vertical components of daylight and of the total solar and sky radiation.

This ratio has also been determined experimentally by comparing photometric measurements of daylight illumination on a horizontal surface with continuous records of the total solar and sky radiation made by a U. S. Weather Bureau thermo-electric pyrheliometer horizontally exposed.

J. PATTERSON.—*Upper Air Observations in Canada.*

Upper-air observations were commenced in Canada in 1911, but were partially interrupted by the war. It has not yet been possible to get balloons for carrying instruments equal to those of pre-war days; there

are, however, good prospects of overcoming this handicap in the near future. During the past year an automatic apparatus for calibrating the meteorgraphs has been installed and the Dines meteorograph simplified. The results of the sounding balloon ascents during the past five years are discussed, as also the observations with pilot balloons in the arctic. It is expected that these arctic observations will soon be extended on a permanent basis.

W. J. HUMPHREYS.—*Rainmaking.*

The paper discusses attempts to produce rain by producing loud noises, by the use of chemicals, by mechanical or forced convection, by fog-collecting screens, by dusting the sky, by spraying liquid air on clouds, and by sprinkling clouds with electrified sand. None of these methods is commercially practicable.

C. F. MARVIN.—*Let us Simplify the Calendar and Publish Statistical Data in Standardized Summaries.*

The paper proposes a simple equal-month calendar and also that standard and representative data be published in comprehensive summaries.

SIR NAPIER SHAW.—*If the Earth Went Dry.*

The paper discusses what the general circulation would be if there were no water vapor present.

SIR FREDERIC STUPART.—*The Variableness of Canadian Winters.*

In normal seasons North Pacific cyclonic areas usually move southeastward, with their centers well off the coast until at about latitude 60° N. they enter the continent, while anti-cyclonic conditions of moderate intensity with low temperature prevail in Yukon and the MacKenzie River.

In certain years, however, the Pacific cyclonic areas are less intense and enter the continent further south, while great anti-cyclonic developments occur in the far north and sweep south-eastward over Canada, accompanied by severe cold waves, which often reach the Atlantic coast. These conditions lead to abnormally cold winters in Canada.

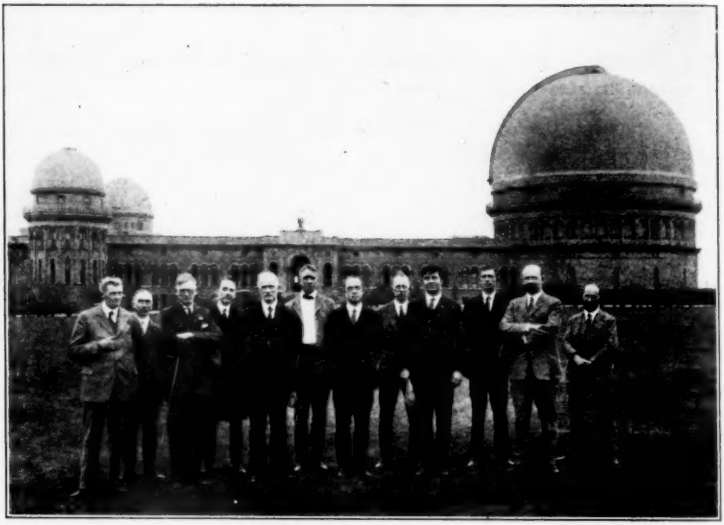
In other years the North Pacific cyclonic areas appear to be of such intensity that they force their way into the continent in high latitudes and actually prevent the formation of anti-cyclones and their concomitant low temperature. These conditions lead to mild winters in Canada.

The Meteorological Service is investigating whether there is any connection between the temperature and position of the Japan current and the behavior of these cyclonic areas.

MEETING OF ASTRONOMERS OF THE SIXTH CORPS AREA.

By PHILIP FOX.

For the last two years astronomers in the neighborhood of Chicago have been holding occasional informal meetings for the discussion of research problems. The last meeting for this season was held at Yerkes Observatory on May 17, 1924. In addition to the members of



ASTRONOMICAL CONFERENCE, AREA OF THE SIXTH CORPS, YERKES OBSERVATORY, MAY 17, 1924.

Left to right: Comstock, Parkhurst, Frost, Crew, Hussey, Lee, Curtiss, Urie, Fox, Baker, Stebbins, Van Biesbroeck.

the Yerkes Observatory staff the following astronomers were in attendance: G. C. Comstock, Henry Crew, W. J. Hussey, R. H. Curtiss, R. H. Baker, F. D. Urie, Joel Stebbins, and Philip Fox.

Professor Hussey, who recently returned from a survey of conditions in South Africa, reported on results for the selection of a site for the University of Michigan station in the southern hemisphere. The following note from Professor Hussey summarizes his statement:

A PROPOSED SOUTHERN ASTRONOMICAL EXPEDITION.

By W. J. Hussey.

In November, 1902, Mr. R. P. Lamont, of Chicago, visited the Lick Observatory and we then had our first conversation concerning the desirability of sending a large telescope to the southern hemisphere for the measurement of double stars and for the extension of the double star survey to the south celestial pole. In February, 1911, Mr. Lamont authorized me to order the glass for a twenty-four-inch objective, and to begin the construction of the mounting for the telescope at the University of Michigan. The glass was first ordered from France and, after waiting two years without receiving it, a duplicate order was placed in Germany. Eighteen months later the great war began and caused years of delay. At the end of the war the glass was ordered anew from an American maker of optical glass and three more years passed without the disks being produced. In answer to an inquiry made in August, 1922, we learned that they were annealing at Jena a pair of unsold disks, twenty-eight inches in diameter, suitable for a twenty-seven-inch objective, which we could have if ordered immediately, but that they had no other stock on hand from which large disks could be made and might not have any for one or two years. The American maker very courteously cancelled our order to enable us to secure these disks, which were received by Mr. McDowell, at Pittsburgh, early in April, 1923. Tools had already been prepared for making the objective and during the summer the work progressed so favorably that Mr. McDowell expected to complete it by October, 1923. His untimely death has caused delay, but work upon it has now been resumed and it is hoped that it may be finished before the end of the present year.

My trip to South Africa was for the purpose of selecting a site for this telescope. Information from various sources rendered it probable that a good location could be found in the interior of the country on the high veld. Dr. Innes, director of the Union Observatory, recommended Johannesburg, or some place in its vicinity. The late Sir David Gill, for many years director of the Royal Observatory at Cape Town, Colonel Morris, long associated with the South African Geodetic Survey, Dr. Halm, recently Acting Astronomer Royal at Cape Town, and Senator A. W. Roberts, of Lovedale, all recommended Bloemfontein, the capital of the Orange Free State. On account of these recommendations, and also because its latitude is more nearly that for which the telescope has been constructed, Bloemfontein was selected as the place at which to make the tests of seeing. A ten-inch telescope was sent there. The objective was a new one, made last year by Mr. McDowell. The mounting was that of the old six-inch telescope of the University of Michigan, with a new tube to accommodate the larger objective. This instrument was in use at Bloemfontein during the months of December and January, 1923-24. Although this was the rainy season for that part of the country, most of the nights were clear. The atmosphere was usually very transparent, and on many of the nights the seeing was excellent. Sir David Gill states, and his statement is confirmed by others, that some three hundred clear nights in a year may be expected in this region. The winter season is said to be nearly

cloudless. The rains come mainly in the summer, and are often of a somewhat local character. When completed it is probable that the Lamont telescope will be sent to Bloemfontein for work on the southern double stars and for other observations.

Ann Arbor, Michigan.
June 20, 1924.

Professor Oliver J. Lee of Yerkes Observatory staff reported on his work on the Kapteyn Systematic Plan of Selected Areas. The series of plates are complete and the measures of them are finished and reduced and discussion of the results is well forward. A number of very interesting matters are cropping out as the measures are studied, both from the standpoint of stellar parallax and of proper motion. If the preliminary studies are verified by the complete discussion of results, and if the results are re-inforced by findings from zones allotted to other astronomers, there will be need of very considerable revision in some of our ideas as to the distribution of stars and their motions.

Much of our discussion in these two fields is based on rather meager evidence, and it was on account of this that Professor Kapteyn devised his scheme for a more systematic and comprehensive survey.

Professor John A. Parkhurst continued the discussion, giving a discussion of the instruments used for determining the photographic and photo-visual magnitudes, the color indices and spectral classification of about 1500 stars in the 24 areas at $+45°$, and mentioning the correlations which would follow from comparisons of the photometric and astrometric work.

As various members present, notably Professor Comstock, had been interested in various phases of star motions, the discussion of Professor Lee's work was very lively.

The last topic of discussion was presented by Professor R. H. Curtiss of the University of Michigan, who reviewed the work of the spectrographic program of the University of Michigan. The work centered on two principal items, the first of which is the rotation effect in the study of eclipsing binaries, showing that when the brighter star of the eclipsing pair is nearly occulted, leaving but a limb exposed, a rotational effect is observable. The other and more important item concerned the theory of variability of the Cepheids. This he ascribes to pulsation and as evidence for it compares the phase of velocity curve as shown by different lines in the spectra. As a star begins to brighten, the lines which we have evidence to believe lie low in the star's atmosphere are the first to show a change in velocity. Lines produced by intermediate and higher lying elements show successive lag in indicating change of velocity, as would be the case in periodic impulsation. The observations of several Cepheids give harmonious results. The following by Professor Curtiss summarizes his observations:

RÉSUMÉ OF REMARKS CONCERNING RECENT STUDIES OF CEPHEID VARIABLES AT THE DETROIT OBSERVATORY.

By R. H. Curtiss.

In recent studies of Cepheid variables by Dr. J. A. Aldrich, Dr. W. C. Rufus, and the writer, an attempt has been made to investigate the velocity curves corresponding to layers of the atmosphere absorbing at different effective levels. The hydrogen lines have been used as a group at the highest level available. The great majority of the measurable lines have formed a group of reversing layer or low level lines, and selected chromospheric lines have been combined into means representative of intermediate levels. This sorting out of lines at different levels has been based on solar atmospheric heights by Mitchell and on solar atmospheric levels by St. John.

The velocity curves for the several groups of lines presumably at different levels show pronounced differences. At the highest or hydrogen level (H and K of calcium were not measurable) the velocity curve indicates a lag of phase suggesting that the whole cycle of motion of this region is delayed with reference to the layers beneath. For the intermediate layer the effect is probably intermediate in character but as yet in these studies is not so definitely indicated. Aldrich's curves in the case of S Sagittae, for the three levels mentioned, exhibit a progressive lag of phase, with some individual exceptions, from the lowest to the highest levels and probably increased range with higher level.

Besetting such analyses there are of course difficulties especially due to varying intensities of lines in blends. There are also embarrassing uncertainties in the matter of effective absorbing levels. Many plates on a number of stars, both Cepheids and normal objects, are needed in connection with this problem. At present probably no adequate explanation of all curves found is possible. But if the light variation of Cepheid variable stars is accounted for on the basis of pulsations, a theory now quite generally accepted, the conclusion seems unescapable that these pulsatory motions originate below the effective radiating layers and are communicated first to the lowest of the overlying absorbing layers and thence upward through successive levels to the highest. The effect on any absorbing layer would be a rise and fall with each pulsation which would cause a cyclic Doppler shift in the dark lines produced by such a layer. A velocity curve derived from a dark line produced at a low level in the star's atmosphere would tend to precede in its phases the corresponding curve based on a dark line originating at a higher level. The hydrogen or enhanced calcium lines, if produced at the highest levels, would exhibit the greatest phase delay. The form and range of the curves at different levels would probably differ. The velocity curves which have been derived for Cepheid variables in the past were mean curves based on absorption lines originating at many altitudes.

The relative motions of adjacent layers, which are indicated by their velocity curves, would lead to stages of compression and expansion in and above the effective radiating layers. Periods of compression would lead to increased temperature, increased radiation and reduced atmospheric absorption, all of which would be associated with in-

creased emission and would culminate in a light maximum. Periods of expansion would lead to lower temperature, reduced radiation, and increased absorption which would entail declining luminosity and a fall to a light minimum. Aldrich's curves of relative velocity in different layers of the atmosphere of S Sagittae are in accord with this supposition but corroboration is needed in other stars.

The above explanation of the velocity curves derived from lines of different levels in the atmospheres of Cepheid variables and the suggested relation of such curves to the light changes are of course preliminary. There are many considerations which point to great complexity in the phenomena involved. Thus the pulsations travelling upward are undoubtedly reflected more or less at higher levels and lead to something like a steady vibratory state. Probably there are overtones in the vibrations. Undoubtedly also there are physical conditions other than radial motion which are productive of cyclic changes in wave-length of the spectral lines.

Studies of several Cepheid variables, including S Sagittae, η Aquilae, ζ Geminorum, W Sagittarii and δ Cephei, are in progress at the Detroit Observatory. Dr. J. A. Aldrich, Dr. W. C. Rufus, and Dr. R. H. Curtiss have been working together in the derivation and interpretation of data.

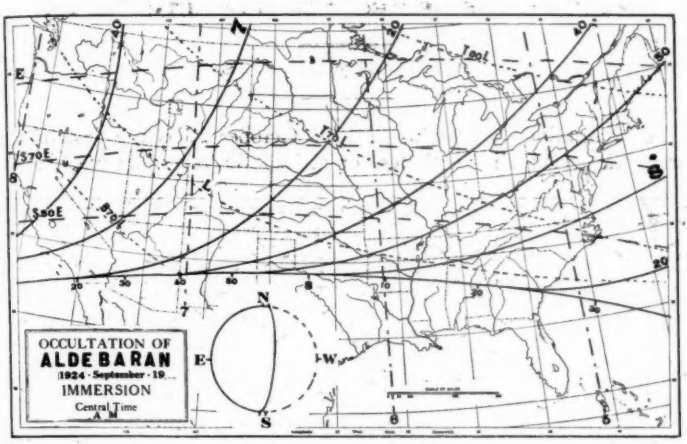
All other meetings of this group have been held in Chicago. The change to Yerkes Observatory was found to be very pleasant and probably more profitable.

A photograph of the group has one point of interest that should be noted. The American Astronomical Society has had since its organization but four secretaries,—G. C. Comstock, W. J. Hussey, Philip Fox, and Joel Stebbins, and there have been two acting secretaries, E. B. Frost and R. H. Curtiss. On the front row of the photograph will be seen these six secretaries in chronological order from left to right. It is noted that the astronomers of the group are from the states of Wisconsin, Illinois, and Michigan, an area which coincides with the district known as the Sixth Corps Area. The astronomers seemed not averse to having themselves designated as astronomers of the Sixth Corps Area, although the nature of their profession compels them to take in considerably more territory in their outlook.

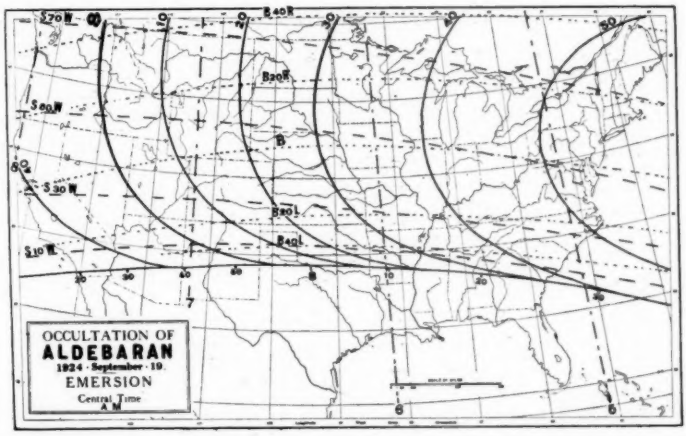
OCCULTATION OF ALDEBARAN 1924 SEPTEMBER 19.

By WILLIAM F. RIGGE.

The occultation of Aldebaran on September 19 will be visible to all but the Gulf states. It will occur in the morning, the beginning just before sunrise for the Pacific coast, and the end at about 10 A. M. Eastern time, for the Atlantic states. On both the annexed maps the



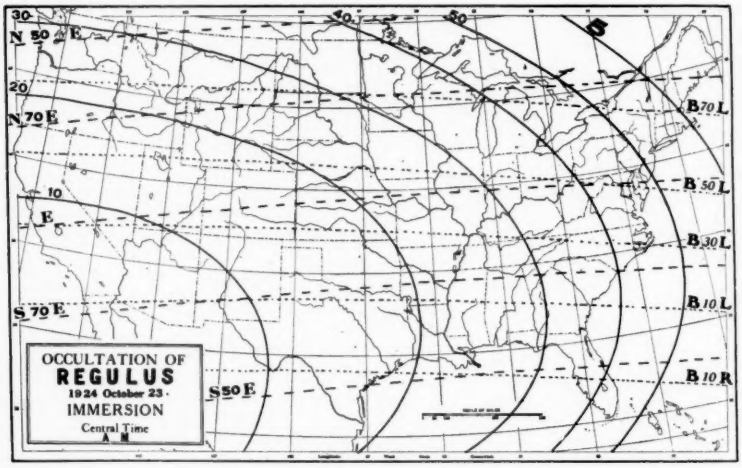
full lines give the time, the large 7 and 8 meaning 7 and 8 A. M. Central time. The dashed lines measure the position angles from the cardinal points N, S, E, W, while the dotted ones measure them from T, B, L, R, the top, bottom, left, and right. The straight lines marked 5, 6, 7, 8, at the bottom indicate the full hours of the Central times of sunrise. The insert in the map above shows the phase of the moon, 20.2 days old, or near Last Quarter. The north end of its terminator is in position angle N 5° 40′ W.



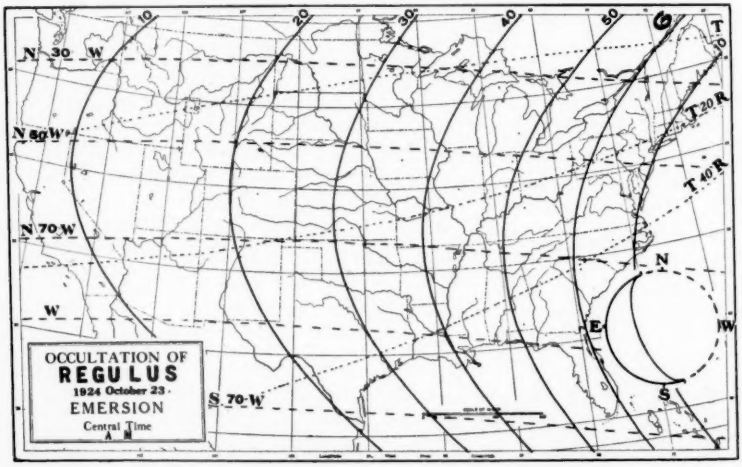
OCCULTATION OF REGULUS 1924 OCTOBER 23.

By WILLIAM F. RIGGE.

The occultation of Regulus of 1924 October 23 is the first of that star visible in the United States for at least 25 years. It may be said



to have only one discordant feature, in that it takes place rather early in the morning, especially for our western friends.



On the annexed maps the full lines give the times for every ten minutes, the large 5 and 6 meaning 5 and 6 o'clock A. M. Central time. The dashed lines show the position angles as measured from the moon's N or S points towards the E or W, and the dotted lines give them as measured from its top T or bottom B towards the left L or right R. The moon is a crescent, 24.7 or —4.8 days old, and the star is of the 1.3 magnitude. The north end of the moon's terminator is 20° 38′ to the east of the north point of the disk.

THE DRIFT OF JUPITER'S MARKINGS.

By LATIMER J. WILSON.

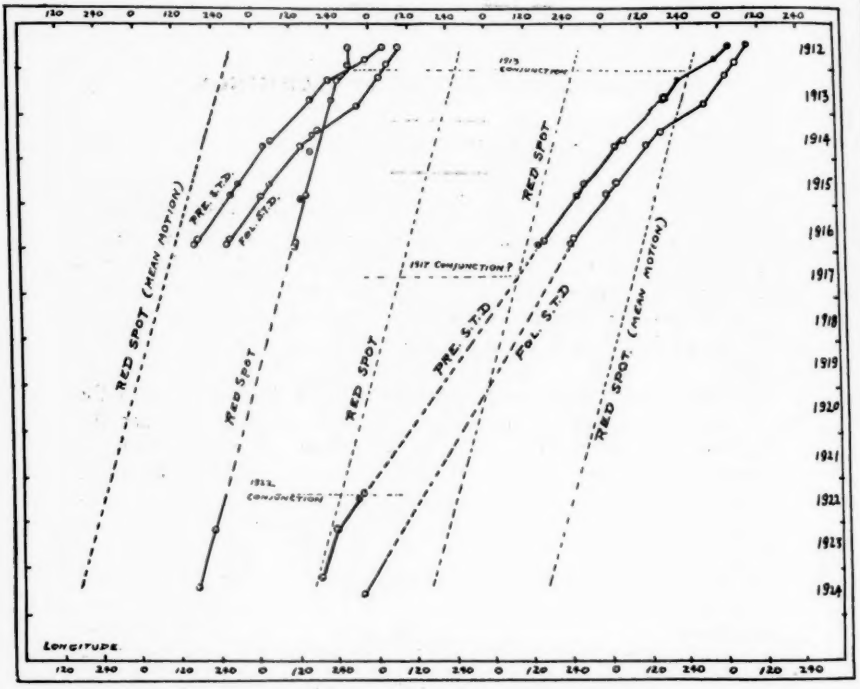
Observation of Jupiter's markings to determine their variation in longitude from the theoretical zero meridian, which was begun here in 1912 and discontinued in 1916, is again being resumed. A few longitudes were obtained in 1922, 1923, and a number have been recorded during the present summer, 1924. The results of the work prior to 1916 can be found in POPULAR ASTRONOMY, Numbers 195, 208, 227 and 241.

From all these observations a graph has been drawn in which the gap from 1916 to 1922 is occupied with a line constructed from the mean motion of the marking it represents. The mean motion of the Red Spot based upon 1912 to 1916 inclusive brings the line to the point at present occupied by this marking. But a marked change has undoubtedly occurred in the motion of the preceding part of the south tropical dark area.

Readers not familiar with the bibliography of Jupiter should know that the Red Spot has been the planet's only permanent marking which could be persistently identified since its discovery in 1878. At first dark red in color, it soon faded until all trace of the red had disappeared, but a deep white notch, cut below the elliptical spot into the southern component of the two belts which border the equatorial zone on the south, has served to identify the place of the Red Spot. Occasional glimpses of a pinkish oval within the white elliptical marking have been seen. The average length of the white ellipse is about 34 degrees and it completely fills the width of the south tropical zone, between the parallels —15 and —25 degrees.

Within the past score years another curious marking has appeared in this same latitude. It is characterized by a brilliant white loop followed by a dark area of varying length and terminated by another white loop in a reversed position to the first. The loop at the head of this area has been called the Preceding Part of the South Tropical

Dark Area, while the loop at the rear end of the disturbance has been referred to as the Following Part of the South Tropical Dark Area. For the sake of brevity we shall refer to these markings as: Pre. S. T. D., (preceding part of south tropical disturbance), and Fol. S. T. D., (following part of the south tropical disturbance). The red spot bay, or hollow cut into the southern equatorial belt, is referred to as the R. S. H., (red spot hollow). These three markings are semi-permanent and, by timing their transits across the central meridian of

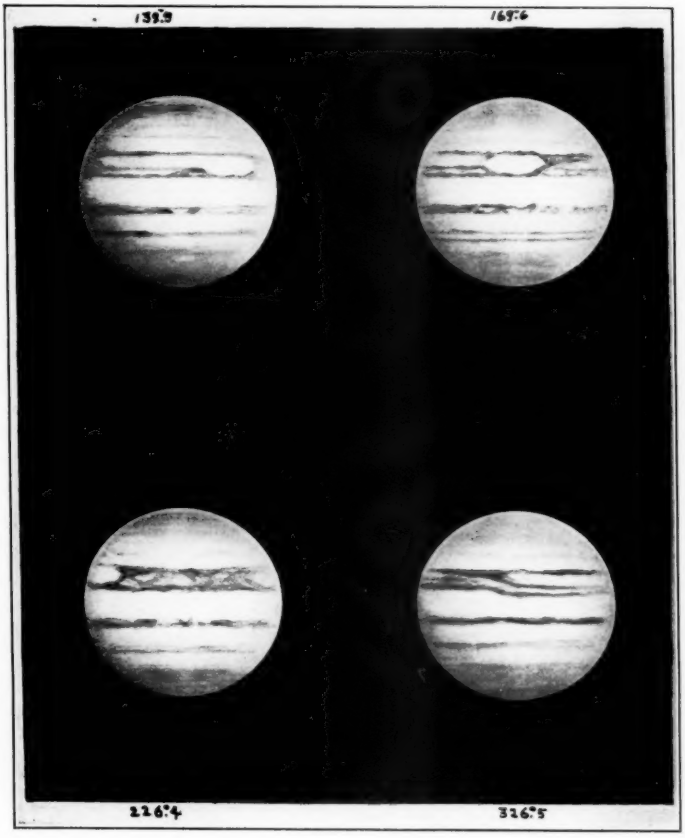


The effect of Jupiter's Red Spot upon the Motion of the Preceding and Following Ends of the South Tropical Dark Area (Pre. and Fol. S. T. D.).

the disk of Jupiter, their longitude with relation to the zero meridian can be found.

Apparently, from 1912 to 1922 the preceding part of the S. T. D. has had a forward motion more rapid than that of the red spot. In the early part of 1913 it reached the red spot and passed it, losing its identity during the conjunction of the two markings, but reforming immediately after conjunction. The same phenomenon was observed when the following end of the S. T. D. came to the red spot, except that after conjunction it disappeared close to the marking it had ap-

PLATE XX.



JUPITER IN 1924.

Drawings by Latimer J. Wilson, Nashville, Tennessee.

Upper left: June 14, 1924
17h 15m G. M. T. = 139°.9
Lower left: June 12, 1924
18h 10m G. M. T. = 226°.4
Upper right: June 14, 1924
18h 04m G. M. T. = 169°.6
Lower right: July 2, 1924
17h 14m G. M. T. = 326°.5

parently conflicted. Then a new white loop characterizing the rear of the S. T. D. formed eighty-seven degrees from the Pre. S. T. D. when that had reached a point some 155 degrees ahead of the red spot. That occurred in July, 1915. The center of the red spot was then at 173 degrees; the preceding part of the S. T. D. was far ahead, at longitude 328 degrees, while the new white loop of the following part was at longitude 55 degrees.

The head of the S. T. D. has ordinarily possessed a slightly more rapid forward motion than the rear of the dark area, consequently the dark area lying between the two white loops has been gradually drawn out in extent until at times it reached across the whole disk, a span of more than 170 degrees. Nearing conjunction with the red spot a marked alteration in the motion of both markings has been noted. The effect of approach to the red spot has apparently quickened the forward motion of the Pre. S. T. D. and has somewhat retarded the forward motion of the red spot. After conjunction the opposite was noted. The motion of the red spot was hastened while that of the Pre. S. T. D. was slowed down (See POPULAR ASTRONOMY, Numbers 208, 227 and 241).

Small elliptical dark spots of great intensity in the southern component of the south equatorial belt were observed to be drawn backward toward the Pre. S. T. D., and as they passed under the white loop of the latter they were seen to tilt up on end as if caught into currents leading into a vortex.

A remarkable change has occurred in the south tropical dark area and in its motion. The conjunction of this marking with the red spot which occurred in 1913 was evidently followed by a similar one in 1917. This was during the period when observations were not made here, and I have seen no reference to the matter in publication. But one was due to occur in 1917, and another in 1922. Observation of the planet on May 30, 1922, showed the preceding part of the south tropical dark area in conjunction with the rear of the red spot hollow, at longitude 326 degrees. On July 29, 1922, they were in the same position at longitude 313 degrees. In April, 1923, the conjunction had apparently not ended, and the two were seen at longitude 241 degrees, (the center of the red spot hollow was at long. 224 degrees). Still, in May, 1924, the conjunction was apparent by the identification of the markings and the preceding part of the S. T. D. was found at the rear of the red spot hollow, at longitude 190 degrees (the center of the red spot was 170 degrees). A well defined loop marked the end of the S. T. D. at longitude 326 degrees (July, 1924). Thus the dark area extends the length of 136 degrees, and is marked with deep gashes slanting diagonally across it from northwest to southeast. Central, at longitude 240 degrees, was seen a darker area as large as the red spot hollow.

The apparent effect of the red spot is that of victory over its rival, the south tropical disturbance. From a consideration of the motions

a striking similarity in the direction of movement of ocean currents near the equator in the earth's southern hemisphere is noted, the red spot acting as a large land area in deflecting the motions which come in contact with it.

In the opinion of the writer, possibly the dark markings on Jupiter may represent regions of greater density and in a broad way might be compared with the high pressure, clear weather, regions of the earth's atmosphere. The white loops of the south tropical dark area show signs of vortical influence, judging from the behavior of spots passing them (See POPULAR ASTRONOMY, Number 195). The ephemeral character of nearly all the intensely dark spots might strengthen the comparison, showing that though they appear with frequency they are soon consumed by their environment, unless, like the darkest portion of the south tropical disturbance, they are of vast extent. That the force underlying the great red spot is a strong obstacle in the way of other markings there is ample proof. Possibly, here is something different from merely an atmospheric phenomenon.

CENTER OF RED SPOT HOLLOW.

		°		°
1912.	July,	322	October,	297
1913.	March,	277	August,	255
1914.	June,	209	November,	199
1915.	August,	175	October,	164
1916.	August,	135	November,	132
1922.	May,	309	July,	306
1923.	April,	224		
1924.	May,	170		

PRE. S. T. D.

1912.	June,	49	October,	351
1913.	April	239	August,	196
1914.	August,	65	November,	40
1915.	July,	328	October,	304
1916.	August,	194	November,	171
1922.	May,	326	July,	313
1923.	April,	241		
1924.	May,	190		

FOL. S. T. D.

1912.	July,	109	October,	69
1913.	March,	32	August,	325
1914.	June,	195	November,	156
1915.	July,	56	November,	28
1916.	August,	310	October,	302
1922.				
1923.				
1924.	July,	326		

(No certain observation was obtained of this marking in 1922 or 1923.)

1405 Gartland Ave., Nashville, Tenn.

PROBABILITY OF CLOUDINESS FOR THE TOTAL ECLIPSE OF THE SUN ON JANUARY 24, 1925.

By FREDERICK SLOCUM.

In 1917, Professor David Todd sent out a call for volunteers to make observations to determine the probable state of the sky along the path of the total eclipse of the sun to occur on January 24, 1925. The approximate path of the eclipse was indicated as passing near Toronto, Ithaca, Poughkeepsie, Middletown and Nantucket, and the time as about 9:00 A. M., Eastern Standard Time.

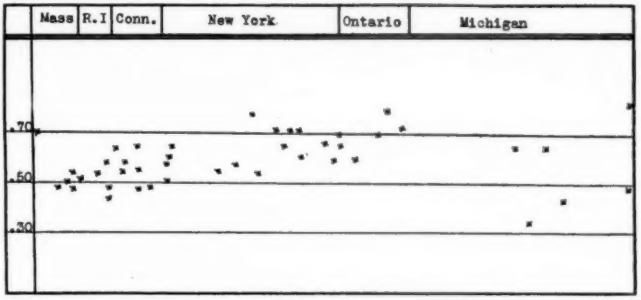


FIGURE 1.
Percentage of cloudiness along the eclipse track in 1918.

In response to this call, observations were sent in from stations extending all the way from Houghton, Michigan, to Nantucket, Mass., and the reports have been turned over to the writer for tabulation. I find reports from 48 stations for 1918 and from 27 stations for 1923. For the other years there are records for from four to six stations only.

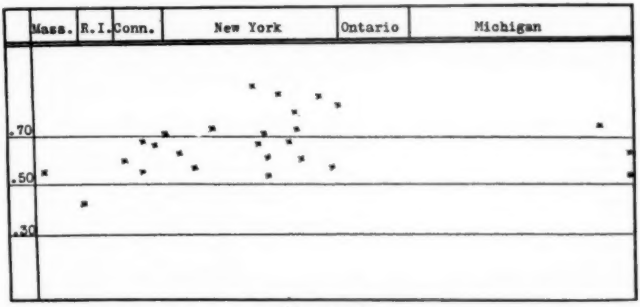


FIGURE 2.
Percentage of cloudiness along the eclipse track in 1923.

Whether the observations for these years were not made at the other stations, or whether the records have been lost, I do not know.

The observations for 1918 extend from January 9 to February 8 and give the percentage of cloudiness over the sky as a whole and also the percentage in the vicinity of the sun. The later observations give, in most cases, only the percentage for the whole sky. From the observations made in 1918 the average cloudiness of the sky as a whole,

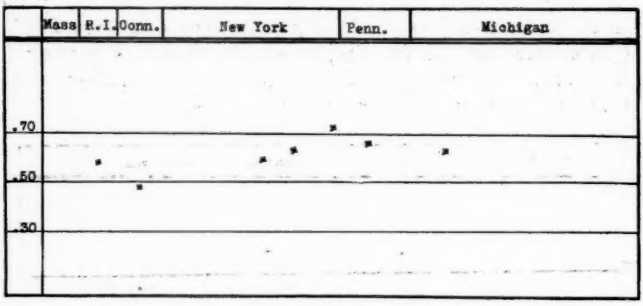


FIGURE 3.
Percentage of cloudiness at weather bureau stations.

between 9:00 and 9:30 A. M. is 59%; for the region near the sun, about 56%. For 1923, the only other year upon which many observations were made, the average cloudiness for the whole sky was 67%.

Table I gives the mean of the observations for each station for 1918 in order of longitude and Figure 1 shows the same graphically. Figure 2 shows the results for 1923. Figure 3 shows the mean percentage of

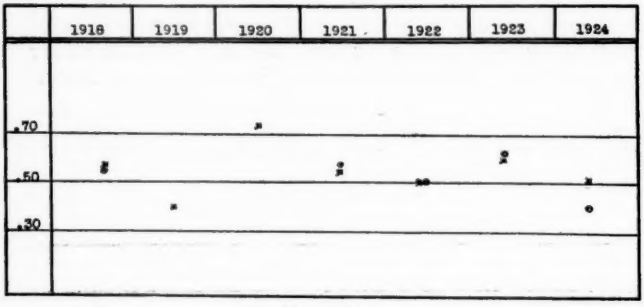


FIGURE 4.
Percentage of cloudiness at Nantucket (x) and at Middletown (o).

cloudiness, between 9:00 and 10:00 A. M., based upon observations made at U. S. Weather Bureau stations, January 16 to 31, 1918 to 1922. Table II gives the reports for four stations, at which observations were made in at least three years and Figure 4 shows the yearly fluctu-

ations for two of these, Nantucket, Mass., and Middletown, Conn.

From all the records, it appears that the probability of cloudy skies during totality ranges from 50% to 70%, except in southern Connecticut, where it is a trifle below 50%. New Haven is the lowest, with 44% at the Yale University Observatory, from records for three years, and 49% at New Haven Weather Bureau, as a mean for five years.

For other reasons also southern Connecticut will be the most favorable region from which to observe the eclipse. The central line runs very nearly through Danbury and New Haven. The altitude of the sun at mid-totality at New Haven will be about 17°.6. This will be the highest altitude available along the central line, except for stations near Montauk Point on the extreme eastern end of Long Island. New Haven also has the highest mean temperature for 9:00 A. M., the average for five years being 24°, while as the track is followed back to the west the average temperatures decrease to 18°, in Michigan. With the possible exception of southern Connecticut and Long Island, there will almost surely be snow on the ground all along the eclipse track.

Although the prospect for good conditions are, on the whole, decidedly unfavorable, yet, as in California last year, the unexpected may happen.

TABLE I.

PERCENTAGE OF CLOUDINESS ALONG THE ECLIPSE TRACK FOR 1918.

Massachusetts		New York		Ontario, Canada	
Nantucket	.70	Poughkeepsie	.54	Welland	.70
Falmouth	.49	Hyde Park	.61	Toronto	.68
New Bedford	.50	New Paltz	.65	Hamilton	.60
		Windsor	.55	Kitchener	.70
Rhode Island		Newark Valley	.57	Harriston	.81
Newport	.54	Trumansburg	.79	Wingham	.73
Little Compton	.47	Ovid	.55	Michigan	
East Greenwich	.52	Naples	.73	Grayling	.65
		Livonia	.67	Bellaire	.34
Connecticut		Mount Morris	.72	Manistique	.42
Stonington	.53	Wyoming	.72	Leland	.66
Norwich	.50	N. Tonawanda	.66	Escanaba	.23
New London	.48	Niagara Falls	.60	Crystal Falls	.50
Greenport	.65			Houghton	.85
Portland	.56				
Middletown	.58				
Naugatuck	.57				
Waterbury	.66				
Danbury	.48				

TABLE II.

PERCENTAGE OF CLOUDINESS ALONG THE ECLIPSE TRACK FOR DIFFERENT YEARS.

	1918	1919	1920	1921	1922	1923	1924
Nantucket	.58	.40	.72	.56	.50	.61	.52
East Greenwich	.53				.42	.42	.38
Middletown	.55			.58	.50	.64	.40
New Haven					.43	.52	.38

Van Vleck Observatory, Middletown, Conn.,
May 29, 1924.

THE GROWTH OF LEGEND ABOUT SIR ISAAC NEWTON.*

By FLORIAN CAJORI.

(1) *The usual explanation of Newton's delay of about twenty years in announcing the law of gravitation* involves what appears to be one of the earliest legendary statements concerning Newton. In a publication issued the year after Newton's death, H. Pemberton[1] states that when Newton in 1666 first tested the gravitational hypothesis by applying it to the earth's attraction for the moon, he used too small a value for a degree of latitude on the surface of the earth (60 English miles instead of the more accurate value of 69½ miles obtained later by J. Picard) and found that "his computation did not answer expectation. On this account he laid aside for that time any further thoughts upon this matter." W. Whiston[2] refers to Pemberton's account and adds that Newton was "in some degree disappointed, . . . however, some time afterward," using 69½ such miles, he verified the law of gravitation. These accounts of the computation of 1665 or 1666 are in direct conflict with Newton's own statement[3] found by the astronomer Adams in the Portsmouth Collection of Newtonian manuscripts: "And the same year (1665) I began to think of gravity extending to ye orb of the Moon and . . . I compared the force requisite to keep the Moon in her Orb with the force of gravity at the surface of the earth, and *found them answer pretty nearly*." Newton does not state what value he took for a degree of latitude, but fairly accurate values were known at that time. Measurements of the earth had been made by Eratosthenes[4] and Posidonius[5] in the third century B. C., by the astronomers of Caliph Al-Mamun[6] in the ninth century A. D., by J. Fernel in 1528, W. Snell in 1617, R. Norwood in 1635. Most of these early measurements were in excess of the modern values, some by as much as 13½ per cent. On the other hand, it is true that English seamen used 60 miles to the degree; this was thought sufficiently accurate for their purposes. It was very convenient in computation, for 60 miles per degree of latitude meant one mile per minute. Thus R. Nor-

*Reprinted from *Science* May 2, 1924.

[1] H. Pemberton, "View of Sir Isaac Newton's Philosophy," London, 1728, Preface; W. W. R. Ball, Essay on Newton's "Principia," London, 1893, p. 10; Sir David Brewster, "Memoirs of . . . Sir Isaac Newton," 2 Ed., Edinburgh, 1860, Chap. II, p. 23.

[2] Memoirs of the Life of Mr. William Whiston by himself, London, 1749 I, p. 35.

[3] W. W. R. Ball, *op. cit.*, p. 7.

[4] Sir Th. Heath, "History of Greek Mathematics," Vol. 2, Oxford, 1921, p. 107; Encyklopädie d. Math. Wissensch., Vol. VI, 1, 1907, p. 223.

[5] Sir Th. Heath, *op. cit.*, p. 220; Encyklopädie, Vol. VI, 1, 1907, p. 223.

[6] Encyklopädie, Vol. VI, 1, 1907, p. 224.

wood[7] used 60 miles in his "Trigonometric" of 1631, and again in the edition of 1678, notwithstanding the fact that he himself in 1635 had found the degree to exceed 69 miles. Moreover, Edmund Gunter and William Oughtred[8] call special attention to the inaccuracy of 60 miles. Gunter[9] says in 1624, "I find that we may allow 352000 feet [66 2/3 miles] to the degree." Oughtred[10] (we suspect from what he says, that he himself had made crude earth-measurements), in 1633, took 66½ miles. These figures are somewhat below those of Snell and Fernel, but would have yielded fairly accurate results in Newton's computation. In the edition of 1657 of Edward Wright's "Certaine Errors in Navigation," 60 miles are given for 1° of latitude in the body of the book, but in an appendix are given about 66 1/3 miles.[11] It appears that none of the measurements, either ancient or modern (except one of the two estimates made by Posidonius) fell as low as 66 English miles to the degree of latitude. Moreover, Richard Norwood published the results of his measurements (69.5 miles per degree) in his "Seaman's Practice," in 1636, a book whose popularity is attested by the fact that it reached its seventh edition in 1667. It should be noted that Norwood, Wright, Gunter and Oughtred were among the most prominent mathematicians of the first half of the seventeenth century in England.

To claim that Newton took 60 miles in a computation requiring great accuracy is like saying that he would take the value 3, instead of 3.14159, for π, when endeavoring to reach very close approximations to circular areas.

But this is not all. Suppose for the sake of argument, Newton had actually used 60 miles in 1665, he knew in 1672 (as we shall see) that this value was too small. Yet not till about thirteen years after 1672 did he announce his law of gravitation. Why should he have waited that long, if the size of the earth had been the real cause of his difficulties in verifying the law of gravity? We know from at least one source that in 1672 Newton had a knowledge of the best earth-measurements. On January 11 and February 1, 1672, Picard's value[12] (69½ miles to the degree) was mentioned at meetings of the Royal Society. Newton was not present at the first meeting and perhaps not at the second.[13] However, an account of Picart's measurements appeared in the *Philosophical Transactions* for 1675, Vol. 10, p. 261. Again, in 1672, there appeared at Cambridge Newton's own edition

[7] Richard Norwood, "Trigonometrie," 1631, p. 102; edition of 1678, p. 147.

[8] Newton as a boy studied one of Oughtred's books and later commented favorably on Oughtred's plans for the education of navigators.

[9] "Works of Edmund Gunter," 5 Ed., London, 1673, p. 280, 281.

[10] W. Oughtred, "The Circles of Proportion," trans. into English by W. Forster, "Addition," London, 1633, p. 21, 27.

[11] W. W. R. Ball, *op. cit.*, p. 15, 16.

[12] S. P. Rigaud, "Historical Essay on . . . Sir Isaac Newton's Principia," Oxford, 1838, p. 9.

[13] S. P. Rigaud, *op. cit*, 1838, p. 7.

of Varenius's "Geographia," which devoted a whole chapter to methods of finding the size of the earth and contained the results reached by Eratosthenes, Posidonius, the Arabic astronomers and Snell.

In 1888 the astronomer J. C. Adams and the mathematician J. W. L. Glaisher came to the conclusion from the study of the Portsmouth Collection of Newton's manuscripts and of his correspondence, that Newton's real difficulty in verifying the law of inverse squares had been not the size of the earth, but the question how a sphere attracts an outside particle.[14] Does the sphere attract as if all its mass were concentrated at its center, or in some other way? In a letter of June 20, 1686, to Halley, Newton said that the previous year (1685) he had been able to clear up this matter. His conclusion is found in his "Principia," Bk. I, Prop. 91.

The investigations of Adams and Glaisher have not received due attention and the legendary account of Pemberton and Whiston is still widely accepted.

(2) *Alleged delay in publication of the "Principia":* A legend of recent origin is that Halley and Wren held up the publication of Newton's "Principia" three years, because Newton would not give credit to Robert Hooke for his prior discovery of the law of universal gravitation. No authority is given for this statement. It is true that when the manuscript of the first book of the "Principia" was presented to the Royal Society, Hooke entered a claim of priority. It is true that there was a correspondence relating to Hooke's claim, and that Newton finally made an acknowledgment. But that it took three years of effort on the part of Halley and Wren to bring this about is wholly untrue. Halley's troubles were different in character. Fearing further controversies, Newton wrote him once, "The third [book] I now design to suppress."[15] Halley needed all the ingenuity at his command to prevent Newton from withdrawing the third book from publication. The manuscript of the first book of the "Principia" was presented to the Royal Society, April 28, 1686, the last part reached Halley in April, 1687; the "Principia" appeared from the press that same year.[16] Instead of a delay of three years, there was a speed of publication quite exceeding that of recent years.

(3) *Was Newton an inventor of the reflecting telescope?* A noted American critic of mathematical books has asserted recently that Newton did not invent the reflecting telescope but simply constructed such telescopes. As authority for this claim the critic refers to the article "Telescope" in the Encyclopedia Britannica, where emphasis is placed upon the fact that, unlike James Gregory and other theoretical inventors of the reflecting telescope, Newton actually constructed such an instrument. A full and explicit statement is made in the article "New-

[14] *Cambridge Chronicle*, April 20, 1888; W. W. R. Ball, *op. cit.*, p. 16, 17.
[15] Weld's "History of the Royal Society," Vol. I, p. 311.
[16] S. P. Rigaud, *op. cit.*, p. 31, 84.

ton," where Newton is credited with the invention. One finds important features of design in Newton's instruments which are contained in none of the previous theoretical designs. Students of history know, of course, that most great inventions and discoveries have been reached by more than one investigator. A description of Newton's instrument was read before the Royal Society, and it was ordered that a letter should be written by the secretary assuring Newton "that the society would take care that all right should be done him with respect to this invention." The telescope which he presented to the society is carefully preserved and carries the inscription, "The first reflecting telescope invented by Sir Isaac Newton, and made with his own hands."[17] Newton acknowledged that he had been acquainted with the telescope proposed by Gregory, before he contrived his own; nevertheless, certainly no one has greater claim to being called an inventor of a reflecting telescope than Newton.

(4) *Action at a distance:* In the preface to the second edition of the "Principia," 1713, the editor, Roger Cotes, advances the doctrine of "action at a distance." Through lack of discrimination, Cotes's doctrine came to be ascribed to Newton himself, even though Newton nowhere expresses his adherence to this doctrine. On the contrary, in a letter to Bentley, February 25, 1692, Newton says:[18] "That gravity should be innate, inherent and essential to matter, so that one body may act upon another at a distance through a vacuum, without the mediation of anything else . . . is to me so great an absurdity, that I believe no man, who has in philosophical matters a competent faculty of thinking, can ever fall into." In his "Opticks (Queries, 18, 22) Newton postulated the existence of an ether. In this century a new meaning is attached to the phrase "action at a distance." Instead of being used in the old sense with reference to the non-existence of a medium intervening between attracting masses, it is now used to indicate an instantaneous action at a distance. In place of an agent we now consider the time of action. But even now the view of Newton is misrepresented. Albert Einstein[19] speaks of "Newtonian action at a distance" as "immediate action." Newton, on the other hand, postulates an agent and gives it time to act. To be sure, in his calculations of gravitational attractions, he assumes, as a necessary approximation, that the action is instantaneous, but not so in his talks on gravity. In a letter to Boyle[20] he considers the cause of gravitation between two approaching bodies.

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[17] Sir David Brewster, *op. cit.*, Vol. I, 1860, p. 40-46.

[18] "Correspondence of R. Bentley," Vol. I, p. 70; Kelvin in *Proceed. of Royal Society of London,* Vol 54, 1893, p. 381. See also S. P. Rigaud, *op. cit.*, Appendix, p. 62, 69.

[19] A. Einstein, "Sidelights on Relativity," transl. by G. B. Jeffery and W. Perrett, London, 1922, p. 4, 5, 17, 18.

[20] "Horsley's Newton," Vol. 4, p. 385; S. P. Rigaud, *op. cit.*, App., p. 62-65.

They "make the ether between them begin to rarify." And again,[21] "So may the gravitating attraction of the earth be caused by the continued condensation of some other such like ethereal spirit," . . . in such a way, . . . "as to cause it [this spirit] from above to descend with great celerity for a supply; in which descent it may bear down with it the bodies it pervades, with force proportional to the superficies of all their parts it acts upon."

(5) *Wave hypothesis of light:* The impression is widespread that Newton rejected the wave hypothesis when he advanced his emission hypothesis. Such is not the case. He showed that the phenomena of colors formed by thin plates might be explained as undulations. With great hesitation did he argue against the wave hypothesis. "'Tis true," he says, "that from my Theory I argue the Corporeity of Light, but I do it without any absolute positiveness, as the word *perhaps* intimates; and make it at most but a very plausible consequence of the Doctrine." And again, "it has a much greater Affinity with his [the objector's] own Hypothesis, than he seems to be aware of; the Vibrations of the Aether being as useful and necessary in this, as in his."[22] Little did Newton suspect that for a whole century his followers would dogmatically insist upon the emission hypothesis and would flatly reject all other explanations, and that even in the twentieth century his study of the possibilities of the wave hypothesis would be overlooked.

University of California.

STANDARD MAGNITUDES OF FAINT STARS IN VATICAN XII.

By J. A. PARKHURST.

It will interest members of the American Association of Variable Star Observers (and others) who work with apertures of six inches and over to know of the charts and magnitudes published by Hagen in "Specola Astronomica Vaticana XII." Fields are given for 146 variables on 143 charts, each 80 mm (3¼ inches) square. They supplement Hagen's Atlas of Variable Stars, Series I, II, III and VI, and include all the faint stars well visible in the 16-inch refractor at the Vatican Observatory, in a field 10′ square around the variable. They also supplement the excellent series of blue-print charts, furnished and used by the Association, in two respects. The Hagen charts give much

[21] S. P. Rigaud, *op. cit.*, App., p. 69, 70.

[22] *Philos. Trans. Abr.*, Vol. I, p. 146. Quoted in G. Peacock, "Miscellaneous Works of the Late Thomas Young," Vol. I, p. 145, 146.

fainter stars, usually to magnitude 14.7 or 14.8, and they give all the faint stars within 5′ or 6′ of the variable.

The accuracy of the configurations on the charts is guaranteed by the fact that the positions of the stars were measured by Professor Anne S. Young on photographs taken with the 24-inch reflector of the Yerkes Observatory. The relation between Hagen's magnitudes and the Harvard system is the main subject of this note.

Hagen's system in his Series I, II, and III is an extension of the system of the Bonn Durchmusterung. In his Series VI and this number XII he has based his magnitudes on Harvard standards, and his values can therefore be used without danger of any departure from the Harvard system.

Using the blue-print charts so far distributed by the A. A. V. S. O. I have made the following comparison with Hagen's magnitudes, separately for Series I, II, III and VI:

Series	Number of fields	Number of stars	Average difference in magnitude Hagen minus Harvard
I	12	130	—0.93
II	19	176	—0.84
III	14	157	—0.67
VI	33	362	+0.09

Vatican XII can be bought in this country from the B. Herder Book Co., 17 South Broadway, St. Louis. The published price is 45 lira ($6.50) plus postage from St. Louis. The weight is three pounds.

THE ALTIMETER.

A Simple Instrument for Measuring the Altitude of a Heavenly Body.

By J. A. PEARCE.

About three years ago, during a course of lectures on elementary astronomy given to the leaders of the Tuxis Organization, Prof. C. A. Chant, of the University of Toronto, proposed the construction of the following type of instrument for measuring the latitude. In addition to knowing the constellations and the facts of elementary astronomy, the boys of this organization were required to make sundials and take observations for latitude with their own instruments, before they could receive the badge of "astronomer." The altimeters constructed at that time proved quite satisfactory.

It is not claiming too much for this simple little instrument to say it can be used to advantage in the teaching of elementary astronomy (questions relating to the celestial sphere) by teachers in small colleges

and secondary schools. Recently the writer made one within an hour and at the small cost of 60 cents, the price of the celluloid protractor.

The details of construction may be seen from the accompanying drawing. Any piece of lumber of the approximate dimensions given will answer for the vertical support. The cross-piece *B* must be planed straight on the upper surface. It is fastened to *A* by a small bolt, the head of which should be countersunk below the surface of the cross-piece. A hollow brass tube of small bore (or an ordinary pea-shooter) is the telescope, and this is mounted on *B* by elastic bands. The tube should be uniform and straight. A pair of cross-wires at the eye end of the tube would serve to define the center and possibly eliminate par-

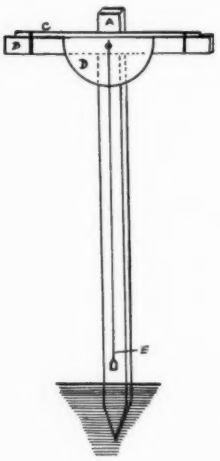


FIG. 1.

A 5′ 6″ × 1½″ × ¾″
B 14″ × 1½″ × ¾″
C 12″ × ⅜″
D 3″ radius, ½ degree protractor.
E Plumb-bob.

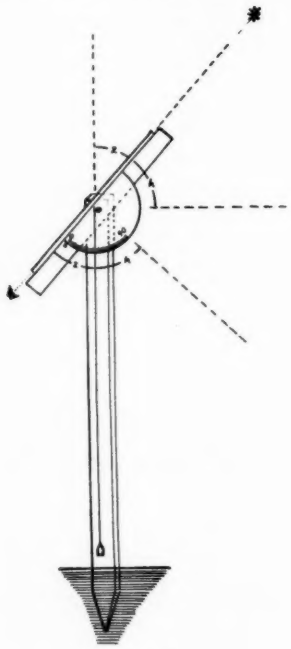


FIG. 2.

allax, but they were not used by the writer. A celluloid protractor, with its edge parallel or even with the planed surface of *B*, constitutes the circle. The plumb-bob is easily constructed from a piece of fine wire and a small weight. The wire is fastened by a screw (countersunk) to the inner surface of *B*; care being taken to have the point of suspension at the center of the circle. The instrument is now complete.

To measure the altitude of a star all that is necessary is to place the instrument in the vertical plane passing through the star and the ob-

server. When the plumb-bob hangs freely and parallel to the upright the altimeter is vertical. Sighting along the tube the star is picked up and when it is brought to the center of the tube, the vertical circle is read to the nearest tenth of a degree. As is shown in the diagram, either the altitude h, or its complement z is read, depending on the graduation of the protractor. The whole operation requires but a minute or two to perform.

As an example of the use of the altimeter we give some observations taken at Berkeley, California, for determining the latitude of the observer.

Tuesday, Jan. 29, 1924, Berkeley, California.

	Star	Local Sid. Time			Apparent Zen. Dist.		Computed Latitude		
		h	m	s	°	′	°	′	
1.	α CMa	4	01	08	66	15	+37	52.3	
2.	α CMa		02	20	66	10	37	58.5	
3.	β Ori		03	50	49	10	38	20.2	
4.	β Ori		06	40	48	50	38	12.1	
5.	β Cet		09	45	74	55	38	02.3	
6.	β Cet		12	15	75	12	37	52.3	
7.	Polaris		18	30	52	00	37	11.0	m s
8.	α Tau		28	50	21	36	37	57.0	$\Delta\theta = +2\ 13$
9.	γ Peg		32	00					$= +1\ 50$
10.	Polaris		37	20	51	50	37	25.0	
11.	α CMa		40	30	61	15	37	36.7	$\Delta\theta = +2\ 02$

Mean Latitude $= +37°\ 50'.7$

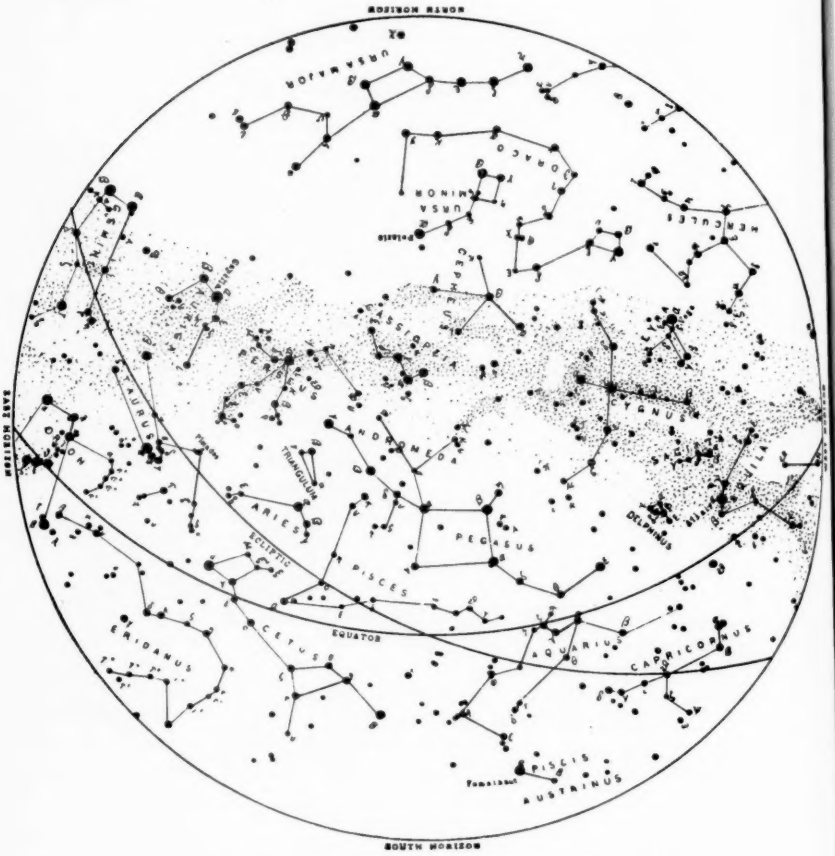
The observations on Polaris were reduced by the method given in the *American Ephemeris*, making use of the corrections to the observed altitudes which are tabulated in table I. For the observations on stars out of the meridian the latitude was computed by the well known formula given in Campbell's *Practical Astronomy*, page 110. The culmination of Aldebaran was observed, which readily furnished both the latitude and the correction to the chronometer. The transit of γ Pegasi across the prime vertical gave another check on the chronometer, the hour angle being computed from the simple relation $\cos t = \tan\delta/\tan\phi$. In the above observations refraction was of course neglected, the observed zenith distances being considered as the true ones. Five place log. tables were used in the computation, although four place tables would certainly have been sufficient. A 1922 *Nautical Almanac* was used to obtain the stars' declinations; but the right ascensions of α Tauri and γ Pegasi were taken from the 1924 almanac.

The mean result of the ten observations for the latitude, by the three methods, gave the value $+37°\ 50'.7$; the true value being $+37°\ 52'.4$. The agreement is rather surprising for such a crude instrument. The observations for time (two methods) were likewise very satisfactory, being of the same order, and agreeing as well as could be expected.

Berkeley, Feb. 7, 1924.

PLANET NOTES FOR NOVEMBER.

The *Sun* will move southeastward from $14^h\ 26^m$, $-14°\ 26'$ to $16^h\ 25^m$, $-21°\ 49'$ during the month. It will move from the constellation Libra into the constellation Scorpio, and at the end of the month will be a few degrees north of Antares.



THE CONSTELLATIONS AT 9:00 P. M. NOVEMBER 1, 1924.

The phases of the *Moon* will occur as follows:

First Quarter	Nov.	3	at 4 P. M.	C.S.T.
Full Moon		11	" 7 A. M.	"
Last Quarter		19	" 12 M.	"
New Moon		26	" 11 A. M.	"

Mercury will be invisible during the first part of the month because of its nearness to the sun. It will move eastward more rapidly than the sun, and toward the end of the month will set about an hour and a quarter after the sun at a point a few degrees south of the point at which the sun sets. Under favorable conditions, therefore, this planet may be seen near the western horizon just after sunset.

Venus will move eastward at nearly the same rate as the sun during this month. It will continue to be a brilliant morning star. On November 19 this planet will pass quite near to the bright star Spica, α Virginis.

Mars during this month will cross the meridian in the early evening. It will increase its distance from the earth by about twenty million miles between November 1 and November 30. At the latter date it will be about eighty million miles away.

Jupiter will be a short distance east of the sun, but too near it to be observed during the month. At the end of the month it will cross the meridian about one hour after the sun.

Saturn will again be visible just before sunrise. At the end of the month it will be somewhat more than thirty degrees west of the sun. It will still be too low for favorable observations.

Uranus will be visible in the early evening. It will cross the meridian at $7^h\ 41^m$ on November 14. On November 27 Uranus and Mars will be very close to each other in the sky.

Neptune will be in quadrature with the sun on November 14. It will then be on the meridian at sunrise. On the morning of November 19 Neptune will be occulted by the moon (see table below).

Occultations Visible at Washington.

[*From the American Ephemeris*]

Date 1924	Star's Name	Magnitude	IMMERSION. Washington M.T.	IMMERSION. Angle from N	EMERSION. Washington M.T.	EMERSION. Angle from N	Duration
			h m	°	h m	°	h m
Nov. 7	14 Ceti	5.4	11 10	25	12 14	278	1 4
12	75 Tauri	5.2	5 42	57	6 33	273	0 51
12	264 B. Tauri	4.8	6 44	136	7 11	191	0 27
14	71 Orionis	5.1	8 57	123	9 44	217	0 47
18	ψ Leonis	5.6	13 38	49	14 22	336	0 45
18	NEPTUNE	7.7	13 49	69	14 53	318	1 4
30	υ Capricorni	5.3	4 28	35	5 30	292	1 2

MARS.

Blazing redly 'mong the stars,
Brightly shines the ruddy Mars,
Shall we see upon its girth,
As the planet nears the earth,
Snowcap, sea, canal and plain?
Shall we signal Mars in vain?

LESLIE C. BEARD.

Hagerstown, Md., July 7, 1924.

VARIABLE STARS.

Minima of Variable Stars of Short Period.

[Calculated by members of the class in General Astronomy at Carleton College.]

Given to the nearest hour in Greenwich mean time; to obtain Eastern Standard time subtract 5^h; Central Standard time 6^h, etc.

Star	R.A. 1900	Decl. 1900	Magnitude	Approx. Period	Greenwich mean times of minima in 1924 November							
	h m	° ′		d h	d h	d h	d h	d h	d h	d h	d h	d h
SY Androm.	0 08.0	+43 09	9.5—13.0	34 21.8					24 21			
RT Sculptor.	31.5	—26 13	9.6—10.5	0 12.3	5 18	13 10	21 2	28 18				
U Cephei	0 52.4	+81 20	7.0— 9.0	1 11.8	4 2	11 14	19 1	26 13				
Z Persei	2 33.7	+41 46	9.4—12	3 01.4	7 0	13 3	19 5	25 8				
TW Cassiop.	37.6	+65 19	8.2— 9.0	1 10.3	5 19	14 8	22 22					
RY Persei	39.0	+47 43	8.0—10.3	6 20.7	6 17	13 14	20 10	27 7				
RZ Cassiop.	39.9	+69 13	6.9— 8.1	1 04.7	1 21	9 1	23 9	30 13				
TX Cassiop.	44.4	+62 22	9.4—10.1	2 22.2	5 20	14 14	23 9					
ST Persei	53.7	+38 47	8.5—10.5	2 15.6	6 21	14 19	22 18	30 17				
RX Cassiop.	2 58.8	+67 11	8.6— 9.1	32 07.6		13 11						
Algol	3 01.7	+40 34	2.3— 3.5	2 20.8	6 11	15 1	23 16					
RT Persei	16.7	+46 12	9.5—11.5	0 20.4	2 23	9 19	23 9	30 4				
λ Tauri	55.1	+12 12	3.3— 4.2	3 22.9	2 2	10 0	17 21	25 19				
RW Tauri	3 57.8	+27 51	7.1— [11	2 18.5	5 18	14 1	22 9	30 16				
RV Persei	4 04.2	+33 59	9.5—11.0	1 23.4	2 4	10 1	17 23	25 20				
RW Persei	13.3	+42 04	8.8—11.0	13 04.8	6 13		19 18					
SZ Tauri	31.4	+18 20	7.2— 7.7	3 03.6	2 3	8 11	21 1	27 8				
RS Cephei	4 48.6	+80 06	9.5—12.0	12 10.1	5 21	18 8	30 18					
TT Aurigae	5 02.8	+39 27	7.8— 8.7	0 16.0	2 22	9 14	22 22	29 13				
RY Aurigae	11.5	+38 13	10.7—11.7	2 17.5	3 1	11 5	19 9	27 13				
RZ Aurigae	42.9	+31 40	10.6—13.3	3 00.3	4 16	10 17	22 18	28 18				
SV Tauri	45.8	+28 05	9.4—11.0	2 04.0	1 22	10 14	19 6	27 22				
Z Orionis	50.2	+13 40	9.7—10.7	5 04.9	7 21	18 6	28 16					
SV Gemin.	54.6	+24 28	9.8— [11	4 00.2	4 16	12 16	20 16	28 16				
RW Gemin.	5 55.4	+23 08	9.5—11.0	2 20.8	6 17	12 11	23 22	29 15				
U Columbæ	6 11.2	—33 03	9.2—10.0	2 19.2	5 19	11 10	22 15	28 5				
SX Gemin.	22.0	+20 37	10.8—11.5	1 08 8	7 2	15 7	23 11					
RW Monoc.	29.3	+ 8 54	9.0—10.8	1 21.7	2 19	10 10	18 1	25 16				
RX Gemin.	43.6	+33 21	8.8— 9.6	12 05.0	8 18		20 23					
RU Monoc.	6 49.4	— 7 28	9.8—10.5	0 21.5	6 10	13 14	20 18	27 22				
R Can. Maj.	7 14.9	—16 12	5.8— 6.4	1 03.3	3 13	10 8	23 23	30 19				
RY Gemin.	21.7	+15 52	8.9— [10	9 07.2	7 20	17 4	26 11					
Y Camelop.	27.6	+76 17	9.5—12	3 07.3	4 9	10 23	24 5	30 19				
TX Gemin.	30.3	+17 08	10.0—11.9	2 19.2	8 22	17 8	25 17					
RR Puppis	43.5	—41 08	9.4—10.7	6 10.3	4 9	10 19	23 16	30 2				
V Puppis	7 55.4	—48 58	4.1— 4.8	1 10.9	7 3	14 10	21 16	28 23				
X Carinae	8 29.1	—58 53	7.9— 8.7	0 13.0	9 0	17 3	25 6					
S Cancri	8 38.2	+19 24	8.2—10	9 11.6	5 14	15 2	24 13					
RX Hydrae	9 00.8	— 7 52	9.1—10.5	2 06.8	7 16	14 13	21 9	28 5				
S Velorum	29.4	—44 46	7.8— 9.3	5 22.4	3 14	9 13	21 10	27 8				
Y Leonis	9 31.1	+26 41	9.3—11.2	1 16.5	7 9	14 3	20 21	27 15				
RR Velorum	10 17.8	—41 36	10.0—10.9	1 20.5	5 21	13 7	20 17	28 3				
SS Carinæ	10 54.2	—61 23	12.2—12.8	3 07.2	5 19	12 10	19 0	25 15				
ST Urs. Maj.	11 22.4	+45 44	6.7— 7.2	8 19.2	8 14	17 10	26 5					
RW Urs. Maj.	35.4	+52 34	10.3—11.4	7 07.9	5 7	12 15	19 23	27 7				
Z Draconis	11 39.8	+72 49	9.9—13.6	1 08.6	6 14	13 9	20 4	26 23				
RZ Centauri	12 55.6	—64 05	8.5— 8.9	1 21.0	5 20	13 8	20 20	28 8				
RS Can. Ven	13 06.3	+36 28	7.5—12.5	4 19.1	7 13	17 4	26 18					
SS Centauri	07.2	—63 37	8.8—10.4	2 11.5	6 19	14 5	21 15	29 2				
SX Hydræ	13 39.0	—26 23	8.6—12.7	2 21.5	7 12	13 7	24 21	30 16				

Minima of Variable Stars of Short Period—Continued.

Star	R.A. 1900	Decl. 1900	Magnitude	Approx. Period	Greenwich mean times of minima in 1924 November					
	h m	° ′		d h	d h	d h	d h	d h	d h	d h
δ Libræ	14 55.6	— 8 07	4.8— 6.2	2 07.9	5 3	12 3	19 2	26 2		
U Coronæ	15 14.1	+32 01	7.6— 8.7	3 10.9	4 7	12 5	19 3	26 0		
TW Draconis	15 32.4	+64 14	7.3— 8.9	2 19.4	5 17	14 3	22 13	30 23		
SS Libræ	15 43.4	—15 14	9.3—11.5	0 18.4	7 22	15 2	22 7	29 11		
SW Ophiuchi	16 11.1	— 6 44	9.2—10.0	2 10.7	2 11	9 19	17 3	24 11		
SX Ophiuchi	12.6	— 6 25	10.5—11.2	2 01.5	8 4	16 10	24 16			
R Aræ	31.1	—56 48	6.8— 7.9	4 10.2	6 18	15 15	24 11			
TT Herculis	16 49.9	+17 00	8.9— 9.3	20 18.1			19 20			
TU Herculis	17 09.8	+30 50	9.5—12	2 06.4	3 11	10 6	23 20	30 16		
U Ophiuchi	11.5	+ 1 19	6.0— 6.7	0 20.1	2 0	10 9	18 18	27 4		
u Herculis	13.6	+33 12	4.6— 5.4	2 01.2	2 8	8 12	20 19	26 23		
TX Herculis	15.4	+42 00	8.3— 9.0	1 00.7	4 5	10 9	22 18	28 22		
RV Ophiuchi	29.8	+ 7 19	9. —12	3 16.5	3 6	10 15	18 0	25 9		
SZ Herculis	36.0	+33 01	9.5—10.3	0 19.6	2 1	10 5	18 9	27 14		
TX Scorpii	48.6	—34 13	7.5— 8.2	0 22.6	6 6	13 19	21 8	28 21		
UX Herculis	49.7	+16 57	8.8—10.5	1 13.2	5 13	13 7	21 0	28 18		
Z Herculis	53.6	+15 09	7.1— 7.9	3 23.8	4 11	12 11	20 11	28 10		
WX Sagittarii	53.6	—17 24	9.2—10.8	2 03.1	4 23	13 11	21 23	30 12		
WY Sagittarii	17 54.9	—23 01	9.5—10.6	4 16.0	1 12	10 20	20 5	29 13		
SX Draconis	18 03.0	+58 23	9.3—10.5	5 04.1	5 16	10 20	21 4	26 8		
RS Sagittarii	11.0	—34 08	5.9— 6.3	2 10.0	4 1	11 7	18 13	25 19		
V Serpentis	11.1	—15 34	9.5—11.1	3 10.9	2 21	9 19	23 14	30 12		
RZ Scuti	21.1	— 9 15	7.4— 8.3	15 03.2		13 8		28 11		
RZ Draconis	21.8	+58 50	9.5—10.2	0 13.2	3 5	10 9	17 13	24 17		
RX Herculis	26.0	+12 32	7.0— 7.6	0 21.3	7 22	15 1	22 3	29 6		
SX Sagittarii	39.7	—30 36	8.7— 9.8	2 01.8	6 2	14 10	22 17			
RR Draconis	40.8	+62 34	9.3—13	2 19.9	3 3	11 14	20 2	28 14		
RS Scuti	43.7	—10 21	9.3—10.3	0 15.9	4 6	10 22	24 4	30 20		
β Lyræ	46.4	+33 15	3.4— 4.1	12 21.8	6 20		19 18			
U Scuti	18 48.9	—12 44	9.1— 9.6	0 22.9	5 13	13 4	20 19	28 11		
RX Draconis	19 01.1	+58 35	9.3—10.2	1 21.4	4 11	12 0	19 14	27 4		
RV Lyræ	12.5	+32 15	11. —12.8	3 14.4	4 9	11 14	18 18	25 23		
RS Vulpec.	13.4	+22 16	6.9— 8.0	4 11.4	4 20	13 19	22 18			
U Sagittæ	14.4	+19 26	6.5— 9.0	3 09.1	1 2	7 20	21 9	28 3		
Z Vulpec.	17.5	+25 23	7.3— 8.5	2 10.9	3 15	11 0	18 8	25 17		
TT Lyræ	24.3	+41 30	9.4—11.6	5 05.8	5 20	11 2	21 14	26 20		
UZ Draconis	26.1	+68 44	9.0— 9.8	1 15.1	4 10	10 23	24 0	30 12		
SY Cygni	19 42.7	+32 28	10. —12	6 00.2	1 9	7 10	19 10	25 10		
WW Cygni	20 00.6	+41 18	9.3—13.4	3 07.6	1 4	7 19	21 2	27 17		
SW Cygni	03.8	+46 01	9. —11.7	4 13.8	2 18	11 22	21 1	30 5		
VW Cygni	11.4	+34 12	9.8—11.8	8 10.3	6 2	14 13	22 23			
RW Capric.	12.2	—17 59	8.8—10.6	3 09.4	4 0	10 19	17 14	24 8		
UW Cygni	19.6	+42 55	10.5—13	3 10.8	3 6	10 3	23 23	30 20		
V Vulpec	32.3	+26 15	8.2— 9.8	37 19.0				30 13		
W Delphini	33.1	+17 56	9.4—12.1	4 19.4	4 16	14 7	23 22			
RR Delphini	38.9	+13 35	10.5—11.8	4 14.4	3 19	13 1	22 5			
Y Cygni	48.1	+34 17	7.1— 7.9	1 12.0	6 10	15 10	24 10			
WZ Cygni	49.3	+38 27	9.9—10.8	0 14.0	5 16	13 7	20 21	28 12		
RR Vulpec	20 50.5	+27 32	9.6—11.0	5 01.2	1 8	11 10	21 13			
RY Aquarii	21 14.8	—11 14	8.8—10.4	1 23.2	1 15	9 12	17 9	25 6		
UZ Cygni	55.2	+43 52	8.9—11.6	31 07.3		12 4				
RT Lacertæ	21 57.4	+43 24	9.1—10.5	5 01.7	1 6	11 10	21 13			
RW Lacertæ	22 40.6	+49 08	10.2—11.2	5 04.4	1 4	11 12	16 17	27 7		
VW Pegasi	51.7	+32 42	10.0—10.6	5 06.4	4 22	10 4	20 17	26 0		
Y Piscium	23 29.3	+ 7 22	9.0—12.0	3 18.4	8 7	15 20	23 9	30 22		
TW Androm.	23 58.2	+32 17	8.6—11.5	4 02.9	1 22	10 4	18 10	26 16		

Maxima of Variable Stars of Short Period.

[Calculated by members of the class in General Astronomy at Carleton College.]

Given to the nearest hour in Greenwich mean time; to obtain Eastern Standard time subtract 5^h; Central Standard time 6^h, etc.

Star	R.A. 1900	Decl. 1900	Magnitude	Approx. Period	Greenwich mean times of maxima in 1924 November					
	h m	° ′		d h	d h	d h	d h	d h	d h	d h
SX Cassiop.	0 05.5	+54 20	8.6— 9.2	36 13.7	2 8					
SY Cassiop.	0 09.8	+57 52	9.3— 9.9	4 01.7	1 9	9 12	17 16	25 19		
RR Ceti	1 27.0	+ 0 50	8.3— 9.0	0 13.3	6 19	14 13	22 7	30 1		
RW Cassiop.	1 30.7	+57 15	8.9—11.0	14 19.2	2 12		17 7			
V Arietis	2 09.6	+11 46	8.3— 9.0	0 23.8	2 23	10 22	18 21	26 19		
SU Cassiop.	2 43.0	+68 28	6.5— 7.0	1 22.8	8 16	16 11	24 6			
RW Camelop.	3 46.2	+58 21	8.2— 9.4	16 00.0		16 14				
SX Persei	4 10.2	+41 27	10.4—11.2	4 07.0	1 19	10 9	18 23	27 13		
SV Persei	42.8	+42 07	8.8— 9.6	11 03.1	6 4	17 7	28 11			
RX Aurigæ	4 54.5	+39 49	7.2— 8.1	11 15.0	3 19	15 11	27 2			
SX Aurigæ	5 04.6	+42 02	8 0— 8.7	1 12.8	5 18	13 10	21 2	28 17		
SY Aurigæ	05.5	+42 41	8.4— 9.5	10 03.3	8 5	18 8	28 11			
Y Aurigæ	21.5	+42 21	8 6— 9.6	3 20.6	6 13	14 7	22 0	29 17		
RZ Gemin.	5 56.6	+22 15	9.1—10.0	5 12.7	1 14	12 15	18 4	29 5		
RS Orionis	6 16.5	+14 44	8.2— 8.9	7 13.6	3 7	10 21	18 10	25 23		
T Monoc.	19.8	+ 7 08	5.7— 6.8	27 00.3			21 14			
RT Aurigæ	23.0	+30 33	5.1— 6.0	3 17.5	2 18	10 5	17 16	25 3		
W Gemin.	29.2	+15 24	6.7— 7.5	7 22.0	5 11	13 9	21 7	29 5		
ζ Gemin.	6 58.2	+20 43	3.7— 4.3	10 03.7	2 4	12 7	22 11			
RU Camelop	7 10.9	+69 51	8.5— 9.8	22 06.5		10 14				
RR Gemin.	7 15.2	+31 04	10.0—11.5	0 09.5	3 16	11 15	19 13	27 12		
V Carinae	8 26.7	—59 47	7.4— 8.1	6 16.7	1 23	8 15	22 1	28 17		
T Velorum	8 34.4	—47 01	7.6— 8.5	4 15.3	7 1	16 8	25 15			
V Velorum	9 19.2	—55 32	7.5— 8.2	4 08.9	5 15	14 9	23 3			
Z Leonis	9 46.4	+27 22	7.9— 9.6	56 08.7						
RR Leonis	10 02.1	+24 29	9.1—10.1	0 10.9	3 21	10 15	17 11	24 6		
SU Draconis	11 32.2	+67 53	8.9— 9.6	0 15.8	3 10	10 0	23 6	29 20		
S Muscae	12 07.4	—69 36	6.4— 7.3	9 15.8	7 2	16 18	26 10			
SW Draconis	12.8	+70 04	8.8— 9.6	0 13.7	1 22	9 22	17 21	25 20		
T Crucis	15.9	—61 44	6.8— 7.6	6 17.6	6 14	13 8	20 1	26 19		
R Crucis	18.1	—61 04	6.8— 7.9	5 19.8	6 16	12 12	24 4	30 0		
S Crucis	12 48.4	—57 53	6.5— 7.6	4 16.6	2 11	11 20	21 6	30 15		
W Virginis	13 20.9	— 2 52	8.7—10.4	17 06.5		17 4				
SS Hydræ	25.0	—23 08	7.4— 8.1	8 04.8	4 14	12 19	21 0	29 5		
RV Urs. Maj.	13 29.4	+54 31	9.2— 9.9	0 11.2	5 23	13 0	20 0	27 1		
ST Virginis	14 22.5	— 0 27	10.3—11.4	0 09.9	4 19	13 1	21 6	29 12		
V Centauri	25.4	—56 27	6.4— 7.8	5 11.9	6 0	11 12	22 12	28 0		
RS Bootis	29.3	+32 11	8.9—10.0	0 09.1	2 14	10 3	17 16	25 5		
R Triang.Austr.	15 10.8	—66 08	6.7— 7.4	3 09.3	1 9	8 4	21 17	28 12		
S Triang.Austr.	15 52.2	—63 29	6.4— 7.4	6 07.8	7 1	13 9	19 17	26 1		
S Normæ	16 10 6	—57 39	6.6— 7.6	9 18.1	9 6	20 0	28 19			
RW Draconis	33.7	+58 03	9.6—10.8	0 10.6	5 15	14 12	23 9			
RV Scorpii	16 51.8	—33 27	6.7— 7.4	6 01.5	5 2	11 4	23 6	29 8		
X Sagittarii	17 41.3	—27 48	4.4— 5.0	7 00.3	3 6	10 6	24 7	31 7		
Y Ophiuchi	47.3	— 6 07	6.1— 6.5	17 02.9		12 21				
W Sagittarii	17 58.6	—29 35	4.3— 5.1	7 14.3	1 13	9 3	16 18	24 8		
Y Sagittarii	18 15.5	—18 54	5.4— 6.2	5 18.6	4 18	10 13	22 2	27 21		
U Sagittarii	26.0	—19 12	6.5— 7.3	6 17.9	4 14	11 7	18 1	24 14		
Y Scuti	32.6	— 8 27	8.7— 9.2	10 08.3	8 5	18 13	28 22			
RZ Lyræ	39.9	+32 42	9.9—11.2	0 12 3	4 17	10 20	23 3	29 6		
RT Scuti	18 44.1	—10 30	9.1— 9.7	0 11.9	3 2	9 1	20 23	26 21		
κ Pavonis	18 46.6	—67 22	3.8— 5.2	9 02.2	3 20	12 22	22 0			
U Aquilæ	19 24.0	— 7 15	6.2— 6.9	7 00.6	1 15	8 16	22 17	29 17		
XZ Cygni	19 30.4	+56 10	8.6— 9.3	0 11.2	2 19	9 19	23 19	30 19		

Maxima of Variable Stars of Short Period—Continued.

Star	R.A. 1900	Decl. 1900	Magnitude	Approx. Period	Greenwich mean times of maxima in 1924 November					
	h m	° ′		d h	d h	d h	d h	d h	d h	d h
U Vulpec.	32.2	+20 07	6.5— 7.6	7 23.5	5 12	13 11	21 11	29 10		
SU Cygni	40.8	+29 01	6.2— 7.0	3 20.3	3 17	11 10	19 2	26 19		
η Aquilæ	47.4	+ 0 45	3.7— 4.5	7 04.2	2 0	9 4	23 13	30 17		
S Sagittæ	51.5	+16 22	5.6— 6.4	8 09.2	5 7	13 16	22 1	30 10		
X Vulpec.	19 53.3	+26 17	9.5—10.5	6 07.7	2 17	9 0	21 15	27 23		
X Cygni	20 39.5	+35 14	6.0— 7.0	16 09.3		11 22		28 7		
T Vulpec.	47.2	+27 52	5.5— 6.1	4 10.5	1 12	10 9	17 6	28 3		
UY Cygni	52.3	+30 03	9.6—10.4	0 13.5	5 17	12 11	19 4	25 22		
RV Capric.	55.9	—15 37	9.2—10.1	0 10.7	4 22	11 15	18 9	25 2		
TX Cygni	20 56.4	+42 12	8.5— 9.7	14 17.4		10 17		25 10		
VY Cygni	21 00.4	+39 34	8.8— 9.5	7 20.6	6 15	14 11	22 8	30 4		
SW Aquarii	10.2	— 0 20	9.9—10.8	0 11.0	7 21	14 19	21 16	28 13		
VZ Cygni	21 47.7	+42 40	8.2— 9.2	4 20.7	5 2	14 20	19 16	29 10		
Y Lacertæ	22 05.2	+50 33	9.1— 9.6	4 07.8	5 5	13 21	22 12			
δ Cephei	25.5	+57 54	3.7— 4.6	5 08.8	2 15	13 9	18 17	29 11		
Z Lacertæ	36.9	+56 18	8.2— 9.0	10 21.1	5 6	16 4	27 1			
RR Lacertæ	37.5	+55 55	8.5— 9.2	6 10.1	5 20	12 6	18 16	25 2		
V Lacertæ	44.5	+55 48	8.5— 9.5	4 23.6	1 23	11 22	16 22	26 21		
X Lacertæ	22 45.0	+55 54	8.2— 8.6	5 10.7	5 5	10 16	21 13	27 0		
SW Cassiop.	23 03.7	+58 11	9.2— 9.7	5 10.6	2 10	13 7	18 17	29 14		
RS Cassiop.	32.6	+61 52	9.0—11.0	6 07.1	5 11	11 18	24 8	30 15		
RY Cassiop.	47.2	+58 11	9.3—11.8	12 03.4		11 23		24 2		
V Cephei	23 51.7	+82 38	6.0— 7.0	0 23.9	3 17	10 17	17 16	24 16		

New Elements of the Algol Variable XX Cassiopeiae.—In *Astronomische Nachrichten* No. 5313, Mr. E. Leiner, of Konstanz, gives new elements and light curve of the Algol-type variable star XX Cassiopeiae. The elements are

Minimum = J. D. 2423369.4211 Gr. M. T. $+3^d.067317$ E.

COMET NOTES.

Comet D'Arrest-Reid (1923 *b*).—These elements and constants of Comet D'Arrest-Reid (1923*b*) are based upon three normals from photographic positions taken by Dr. G. Van Biesbroeck of the Yerkes Observatory and published in *Astronomical Journal* No. 835, page 154. Period seven years.

ELEMENTS.

E =	1924 January 5.51875 G.M.T.	log e =	9.7976115
M =	15° 44′ 25″.37	log a =	0.5631956
ω =	174° 48′ 16″.59	log q =	0.1343256
π =	317° 59′ 8″.67	log p =	0.3458458
Ω =	143° 10′ 52″.08	μ =	507″.2396
i =	18° 2′ 48″.48	P =	2555.005 days

CONSTANTS

$$x = r\,[9.9923833]\,\sin\,(234^\circ\ 33'\ 26''.92 + u)$$
$$y = r\,[9.9950052]\,\sin\,(146^\circ\ 12'\ 32''.57 + u)$$
$$z = r\,[9.3787273]\,\sin\,(\ 94^\circ\ 28'\ 14''.48 + u)$$

F. E. SEAGRAVE.

Monthly Report of the American Association of Variable Star Observers, June 20 to July 20, 1924.

VARIABLE STAR OBSERVATIONS, June 20 to July 20, 1924.

June 0 = J. D. 2423937. July 0 = J. D. 2423967.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
000339 V SCULPTORIS—						
	3965.3	14.3	Bl.			
001032 S SCULPTORIS—						
	3908.3	12.2	Bl,	3965.3	12.2	Bl.
	3934.3	12.3	Bl,			
001046 X ANDROMEDAE—						
	3959.8	13.9	Wf,	3972.8	12.7	Wf.
	3965.8	13.4	Wf,			
001755 T CASSIOPEIAE—						
	3909.6	11.7	L,	3967.8	8.9	Pt,
	3924.6	9.4	L,	3968.8	9.8	M,
	3962.7	9.2	Ca,	3981.7	8.4	Ca.
	3966.5	8.7	L,			
001838 R ANDROMEDAE—						
	3963.8	9.5	Cy,	3967.8	9 8	Pt,
	3966.8	9.5	Gb,	3977.7	9.7	Cd.
001862 S TUCANAE—						
	3881.2	10.0	Sm,	3965.3	13.8	Bl.
	3933.1	12.2	Bl,			
002546 T PHOENICIS—						
	3908.3	8.8	Bl,	3949.1	10.6	Bl,
	3934.3	10.4	Bl,	3965.3	11.9	Bl.
002833 W SCULPTORIS—						
	3908.3	12.9	Bl,	3965.3	12.5	Bl.
	3934.3	13.1	Bl,			
004047 U CASSIOPEIAE—						
	3959.8	13.7	Wf,	3972.8	14.4	Wf.
004435 V ANDROMEDAE—						
	3969.8	10.5	M.			
004435 X SCULPTORIS—						
	3908.3	10.6	Bl,	3965.3	12.3	Bl.
	3934.3	10.7	Bl,			
004533 RR ANDROMEDAE—						
	3959.8	13.8	Wf,	3972.8	12.6	Wf.
	3965.8	13.2	Wf,			
004746a RV CASSIOPEIAE—						
	3965.8	15.0	Wf,	3972.8	15.0	Wf,
	3967.8	10.5	Pt,	3975.7	14.9	Wf.
004958 W CASSIOPEIAE—						
	3967.8	8.9	Pt,	3984.6	9.5	O.
	3969.8	9.0	M,			
005475 U TUCANAE—						
	3880.3	12.0	Sm,	3965.3	13.3	Bl.
	3886.3	12.5	Sm,			
010940 U ANDROMEDAE—						
	3969.8	11.4	M.			
011041 UZ ANDROMEDAE—						
	3960.8	14.8	Wf,	3975.7	14.9	Wf.
	3965.8	15.0	Wf,			
011712 U PISCIUM—						
	3967.8	12.0	Pt.			
012502 R PISCIUM—						
	3967.8	9.9	Pt.			
013238 RU ANDROMEDAE—						
	3960.8	13.2	Wf,	3972.8	12.7	Wf.
	3965.8	13.1	Wf,			
014958 X CASSIOPEIAE—						
	3967.8	11.7	Pt,	3969.8	11.8	M.
015354 U PERSEI—						
	3967.8	8.5	Pt,	3978.7	8.4	Ca.
	3969.8	9.0	M,			
021024 R ARIETIS—						
	3967.8	9.1	Pt,	3986.8	10.0	Ca.
021143a W ANDROMEDAE—						
	3967.8	13.0	Pt.			
021258 T PERSEI—						
	3967.8	8.5	Pt.			
021281 Z CEPHEI—						
	3961.8	14.6	Wf,	3973.8	14.5	Wf.
	3965.8	14.8	Wf,	3977.8	14.2	Wf.
021403 o CETI—						
	3978.8	8.9	Ca.			
021558 S PERSEI—						
	3967.8	8.4	Pt.			
022150 RR PERSEI—						
	3960.8	10.8	Wf,	3967.8	11.1	Pt,
	3965.8	11.2	Wf,	3972.8	11.4	Wf.
022426 R FORNACIS—						
	3934.3	11.4	Bl,	3965.3	11.3	Bl.
022980 RR CEPHEI—						
	3960.8	13.6	Wf,	3973.8	12.4	Wf.
	3965.8	13.5	Wf,			
023133 R TRIANGULI—						
	3967.8	9.8	Pt.			
024356 W PERSEI—						
	3967.8	9.6	Pt,	3974.7	9.8	Cy.
	3967.8	9.2	Ca,			
025050 R HOROLOGII—						
	3934.3	13.0	Bl,	3965.3	11.9	Bl.
025751 T HOROLOGII—						
	3923.9	7.8	Bl,	3965.3	9.7	Bl.
	3934.3	8.8	Bl,			
032043 Y PERSEI—						
	3967.8	8.8	Pt.			
032335 R PERSEI—						
	3967.8	9.6	Ca,	3967.8	9.1	Pt.
043065 T CAMELOPARDALIS—						
	3924.6	8.6	L,	3967.8	7.6	Pt.
	3940.4	8.5	L,			
043263 R RETICULAE—						
	3880.3	7.8	Sm,	3923.9	9.7	Bl,
	3886.2	8.5	Sm,	3933.0	9.7	Bl,
	3897.2	9.0	Sm,	3946.9	10.2	Bl,
	3903.2	8.7	Sm,	3964.9	11.2	Bl.
	3917.0	9.0	Bl,			

VARIABLE STAR OBSERVATIONS, June 20 to July 20, 1924—Continued.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
043274 X CAMELOPARDALIS—						
	3967.8	8.5	Pt.			
043562 R DORADUS—						
	3880.3	4.9	Sm,	3923.9	4.5	Bl,
	3886.2	5.0	Sm,	3925.9	4.5	Bl,
	3897.2	4.8	Sm,	3933.0	4.5	Bl,
	3903.2	4.9	Sm,	3946.9	4.9	Bl,
	3917.0	4.5	Bl,	3964.9	5.4	Bl.
043738 R CAELI—						
	3923.9	9.4	Bl,	3946.8	10.1	Bl,
	3934.3	9.8	Bl,	3965.3	10.7	Bl.
044349 R PICTORIS—						
	3919.9	8.0	Bl,	3934.3	7.6	Bl,
	3923.9	7.9	Bl,	3946.8	8.4	Bl,
	3925.9	8.2	Bl,	3964.9	8.7	Bl.
050022 T LEPORIS—						
	3923.9	11.1	Bl,	3965.3	13.0	Bl.
	3934.9	12.3	Bl,			
050848 S PICTORIS—						
	3880.3	10.8	Sm,	3923.9	10.7	Bl,
	3886.3	11.0	Sm,	3925.9	11.2	Bl,
	3897.2	11.0	Sm,	3934.9	11.7	Bl,
	3903.2	11.4	Sm,	3946.8	11.8	Bl.
	3919.9	11.7	Bl,			
050953 R AURIGAE—						
	3967.8	10.7	Pt.			
051247 T PICTORIS—						
	3880.3	9.9	Sm,	3904.3	12.0	Sm,
	3886.3	10.6	Sm,	3964.9	11.6	Bl.
	3899.2	11.8	Sm,			
051533 T COLUMBAE—						
	3880.3	8.1	Sm,	3923.9	8.0	Bl,
	3886.3	7.7	Sm,	3934.9	8.4	Bl,
	3897.2	7.5	Sm,	3946.8	9.3	Bl.
	3903.2	7.7	Sm,	3965.3	10.3	Bl.
054331 S COLUMBAE—						
	3881.3	12.6	Sm,	3934.9	9.0	Bl,
	3897.2	11.1	Sm,	3946.8	9.2	Bl,
	3903.2	10.2	Sm,	3964.9	9.5	Bl.
	3923.9	9.4	Bl,			
054629 R COLUMBAE—						
	3934.9	11.8	Bl,	3964.9	9.6	Bl.
	3946.9	9.6	Bl,			
055353 Z AURIGAE—						
	3959.7	10.6	Wf,	3971.7	10.8	Wf,
	3964.7	10.7	Wf,	3975.8	10.7	Wf.
055686 R OCTANTIS—						
	3880.3	11.6	Sm,	3917.0	11.7	Bl,
	3886.4	11.6	Sm,	3933.0	11.8	Bl,
	3901.3	11.6	Sm,	3964.9	12.1	Bl.
060547 SS AURIGAE—						
	3908.4	[13.9	L,	3937.6	[11.6	Cy,
	3917.1	[10.8	Ch,	3940.4	[12.4	L,
	3918.4	[13.9	L,	3942.6	[11.6	Kl,
	3921.4	[12.4	L,	3961.7	[12.4	Wf,
	3922.4	[12.4	L,	3963.7	[12.4	Wf,
	3923.3	[12.4	L,	3964.7	[12.4	Wf,
	3926.4	[12.4	L,	3965.8	[13.3	Wf,
	3927.6	[11.8	Kl,	3966.7	[12.4	Wf,
	3928.4	[12.4	L,	3967.8	[12.4	Wf,
060547 SS AURIGAE—Continued.						
	3928.6	[12.3	Lv,	3970.7	[12.4	Wf,
	3928.6	[11.2	Cy,	3971.8	[11.8	Wf,
	3930.3	[12.4	L,	3974.7	[11.8	Wf,
	3936.4	[12.4	L,	3975.7	[12.4	Wf,
	3936.6	[12.4	Cy,	3977.8	[12.4	Wf.
	3937.4	[12.4	L,			
061907 T MONOCEROTIS—						
	3846.3	5.9	Sl,	3856.3	6.7	Sl,
	3847.3	6.1	Sl,	3857.3	6.8	Sl,
	3849.3	6.2	Sl,	3858.3	6.9	Sl,
	3852.3	6.1	Sl,	3871.3	5.8	Sl,
	3854.3	6.3	Sl.	3875.3	6.1	Sl,
	3855.3	6.6	Sl,	3881.3	6.3	Sl.
070310 R CANIS MINORIS—						
	3921.3	10.7	L.			
072708 S CANIS MINORIS—						
	3921.3	7.6	L,	3928.6	8.2	Cy,
	3922.1	7.9	Ch,	3931.1	8.2	Ch.
073508 U CANIS MINORIS—						
	3921.3	10.3	L.			
074241 W PUPPIS—						
	3881.3	8.0	Sm,	3923.9	10.6	Bl,
	3888.3	8.2	Sm,	3933.0	11.6	Bl,
	3899.3	8.5	Sm,	3946.9	12.1	Bl,
	3904.3	9.0	Sm,	3964.9	10.7	Bl.
	3917.0	10.1	Bl,			
074922 U GEMINORUM—						
	3908.4	13.6	L,	3928.6	[13.0	Lv,
	3914.1	[11.7	Ch,	3928.6	[11.4	Cy,
	3917.1	[10.4	Ch,	3930.1	[11.7	Ch,
	3918.1	[10.1	Ch,	3930.3	[13.3	L,
	3918.3	[12.4	L,	3931.1	[11.4	Ch,
	3920.1	[10.1	Ch,	3932.1	[11.4	Ch,
	3921.4	[12.3	L,	3933.1	[11.4	Ch,
	3922.1	[9.5	Ch,	3934.1	[11.4	Ch,
	3922.4	[12.4	L,	3935.1	[11.4	Ch,
	3923.1	[9.5	Ch,	3936.1	[9.5	Ch,
	3923.4	[11.4	L,	3936.4	[12.4	L,
	3924.1	[9.5	Ch,	3936.6	[12.4	Cy,
	3925.1	[9.5	Ch,	3937.1	[9.5	Ch,
	3926.4	[12.3	L,	3937.6	[10.9	Cy,
	3927.1	[10.4	Ch,	3938.1	[9.5	Ch,
	3927.6	[12.4	Kl,	3941.1	[10.3	Ch,
	3928.4	[12.4	L,	3946.1	[9.0	Ch.
081112 R CANCRI—						
	3917.1	7.8	Ch,	3931.1	8.4	Ch.
	3918.6	7.7	L,			
081617 V CANCRI—						
	3931.2	8.9	Ch.			
082476 R CHAMAELEONIS—						
	3904.3	12.4	Sm,	3933.0	11.2	Bl,
	3917.0	12.4	Bl,	3946.9	9.5	Bl,
	3923.9	12.1	Bl,	3962.0	8.6	Bl.
083409 RV HYDRAE—						
	3847.3	8.7	Sl,	3884.3	8.3	Sl,
	3875.3	8.7	Sl,	3897.4	8.0	Sl.
	3881.3	8.3	Sl,			
084803 S HYDRAE—						
	3822.1	8.0	Ch,	3932.1	7.8	Ch.

VARIABLE STAR OBSERVATIONS, June 20 to July 20, 1924—Continued.

Star	J.D.	Est.Obs.	J.D.	Est.Obs.
085120 T CANCRI—				
	3926.4	8.6 L,	3932.1	9.7 Ch.
091868 RW CARINAE—				
	3917.0	10.4 Bl,	3946.9	9.2 Bl,
	3923.9	9.9 Bl,	3962.0	9.4 Bl.
	3933.0	9.5 Bl,		
092551 Y VELORUM—				
	3908.1	12.7 Bl,	3946.9	10.4 Bl,
	3917.0	12.5 Bl,	3949.0	10.5 Bl,
	3923.9	11.7 Bl,	3962.0	10.8 Bl,
	3925.9	11.2 Bl,	3964.9	11.0 Bl.
	3933.0	11.2 Bl,		
092962 R CARINAE—				
	3881.2	7.6 Sm.	3927.9	9.0 Bl,
	3888.2	8.0 Sm,	3933.0	9.5 Bl,
	3899.3	8.5 Sm,	3946.9	9.2 Bl,
	3917.0	8.9 Bl,	3962.1	9.5 Bl.
093014 X HYDRAE—				
	3931.1	8.8 Ch.		
093178 Y DRACONIS—				
	3932.1	9.6 Ch,	3974.6	9.5 Cy.
	3946.7	9.0 Cy,		
093934 R LEONIS MINORIS—				
	3918.2	8.5 Ch,	3956.6	9.6 Mi,
	3918.4	8.2 L,	3956.7	10.1 Pt,
	3932.1	8.9 Ch,	3958.6	10.2 Mi,
	3936.4	8.9 L,	3961.6	10.2 Mi,
	3937.6	9.5 Cy,	3965.6	10.3 Mi,
	3937.6	9.5 Hr,	3969.6	10.5 Mi.
094211 R LEONIS—				
	3915.2	7.8 Ch,	3945.1	5.8 Ch,
	3922.1	6.9 Ch,	3953.6	6.2 Mi,
	3928.6	6.5 Cy,	3956.6	6.5 Mi,
	3928.6	6.7 Js.	3956.7	5.8 Pt,
	3929.6	7.0 Lf,	3957.7	6.5 Lf,
	3933.7	5.5 Sg,	3958.6	6.4 Lv,
	3934.1	6.2 Ch,	3958.6	6.5 Mi,
	3936.6	6.8 Cy,	3958.6	6.1 Ca,
	3936.7	6.7 C.,	3961.6	6.3 Mi,
	3936.7	6.7 Em,	3962.6	6.6 Mi,
	3938.1	6.0 Ch,	3969.6	6.8 Mi.
095421 V LEONIS—				
	3926.7	12.3 Lv,	3956.7	12.8 Pt.
	3936.6	12.7 Cy,		
095563 RV CARINAE—				
	3917.0	11.3 Bl,	3946.9	12.3 Bl,
	3923.9	11.7 Bl,	3962.1	13.3 Bl.
	3933.0	11.8 Bl,		
100661 S CARINAE—				
	3880.3	6.0 Sm,	3917.0	8.2 Bl,
	3886.2	6.1 Sm,	3925.9	8.6 Bl,
	3891.4	6.2 Sm,	3933.0	8.5 Bl.
	3897.2	6.5 Sm,	3946.9	6.5 Bl,
	3903.2	6.8 Sm,	3962.1	7.3 Bl.
101153 W VELORUM—				
	3933.0	13.2 Bl,	3964.9	12.5 Bl.
103212 U HYDRAE—				
	3902.0	6.0 Kd,	3914.9	6.0 Kd.
	3907.0	6.0 Kd,		
103769 R URSAE MAJORIS—				
	3918.2	8.9 Ch,	3955.6	10.8 Ly,
	3928 6	9.0 Ya,	3956.7	10.8 Pt,
	3930.1	9.4 Ch,	3959.6	10.1 B,
	3933.7	9.3 Lv,	3960.8	10.4 Lv,
	3937.7	9.5 Cy,	3961.6	11.0 O,
	3940.1	9.6 Ch,	3963.6	10.6 Ly,
	3940.7	9.8 Kl,	3970.7	10.9 Kl,
	3944.7	9.9 Cy,	3970.7	10.9 Ca,
	3946.2	9.8 Ch,	3974.6	11.2 Cy,
	3951.7	10.4 Sg,	3977.7	10.9 Lv.
	3953.6	10.6 Cd,		
104620 V HYDRAE—				
	3917.0	9.6 Bl,	3937.1	11.0 Ch,
	3923.9	9.9 Bl,	3946.9	9.9 Bl,
	3933.0	10.6 Bl,	3964 9	10.7 Bl.
	3931.1	10.8 Ch,		
104628 RS HYDRAE—				
	3917.0	13.3 Bl,	3964.9	11.6 Bl.
	3933.0	13.0 Bl,		
104814 W LEONIS—				
	3926.7	12.1 Lv.	3937.7	12.4 Lv.
111661 RS CARINAE—				
	3880.3	9.2 Sm,	3923.9	10.0 Bl,
	3886.2	9.2 Sm,	3933.0	11.3 Bl,
	3897.2	9.2 Sm,	3946.9	12.5 Bl,
	3903.2	9.0 Sm,	3962.1	13.3 Bl.
	3917.0	9.4 Bl,		
114441 X CENTAURI—				
	3908.1	13.5 Bl,	3962.1	11.9 Bl.
	3933.0	12.9 Bl,		
115058 Z URSAE MAJORIS—				
	3917.0	11.6 Pl,	3933.0	12.7 Bl.
	3923.9	12.9 Bl.		
115919 R COMAE BERENICES—				
	3925.6	8.6 Lv,	3949.7	8.7 Lv,
	3926.6	8.7 Lv,	3956.7	8.4 Pt,
	3928.6	8.5 Ya.	3957.6	8.9 Lv,
	3937.2	8.7 Ch,	3962.6	8.8 Ca,
	3937.6	8.5 Lv,	3967.7	9.1 Lv,
	3939.6	8.7 Lv,	3977.7	8.9 Cd,
	3942.6	8.7 Ya.	3984.6	9.4 Ya.
120012 SU VIRGINIS—				
	3937.2	9.8 Ch,	3956.7	10.0 Pt.
120905 T VIRGINIS—				
	3928.7	9.5 Lv,	3957.7	9.1 Lv,
	3933.7	9.4 Lv,	3961.7	9.5 Lv,
	3942.6	9.4 Ya,	3968.7	9.2 Lv.
	3956.7	9.4 Pt,		
121418 R CORVI—				
	3928.4	12.7 L.		
122001 SS VIRGINIS—				
	3926.4	7.7 L,	3963.6	8.1 O.
	3937.4	7.6 L,		
122532 T CANUM VENATICORUM—				
	3942.6	9.9 Ya,	3959.6	10.3 M,
	3956.7	10.4 Pt,	3984.6	11.5 Ya.
122803 Y VIRGINIS—				
	3928.4	11.3 L,	3965.6	9.4 O.
	3940.4	10.4 L,		

VARIABLE STAR OBSERVATIONS, June 20 to July 20, 1924—Continued.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
122854 U CENTAURI—						
	3917.0	9.3	Bl,	3933.0	11.2	Bl,
	3923.9	10.1	Bl,	3946.9	12.0	Bl.
123160 T URSAE MAJORIS—						
	3928.6	11.0	Ya,	3940.7	12.2	Kl,
	3928.7	11.7	Cy,	3956.5	12.0	Ro,
	3937.6	12.2	Cy,	3956.7	12.7	Pt.
	3937.6	12.3	Hr,			
123307 R VIRGINIS—						
	3919.4	7.8	L,	3965.6	7.6	Mi,
	3932.7	7.1	Cy,	3966.7	7.6	Mi,
	3936.4	6.8	L,	3969.6	7.7	Mi,
	3956.7	6.8	Pt,	3970.7	7.8	Mi,
	3958.6	7.3	Ca,	3978.6	8.3	Ca.
123459 RS URSAE MAJORIS—						
	3933.2	11.6	Ch,	3962.7	8.6	Ca,
	3933.7	12.3	Lv,	3962.7	8.7	Mi,
	3934.8	12.3	Sg,	3963.6	9.0	Js,
	3937.7	12.0	Cy,	3963.6	9.0	Ly,
	3939.7	11.8	Lv,	3963.7	8.7	Wf,
	3939.7	11.7	Lv,	3963.7	8.6	Cy,
	3940.2	11.2	Ch,	3964.8	8.6	Sg,
	3942.7	11.2	Lv,	3965.7	8.7	Em,
	3943.2	10.8	Ch,	3965.7	8.6	Cy,
	3945.7	9.0	Js,	3967.7	8.9	Hr,
	3952.6	9.0	Cd,	3967.7	8.8	Cy,
	3955.6	9.2	Ly,	3967.8	8.7	Ca,
	3956.6	8.7	Js,	3968.7	8.8	Lv,
	3956.7	9.0	Mi,	3969.7	8.7	Mi,
	3956.7	9.1	Pt,	3971.7	8.8	Wf,
	3957.6	8.7	Mi,	3974.6	8.8	Cy,
	3957.7	8.9	Lv,	3976.7	9.2	Sg,
	3958.6	8.7	Mi,	3977.1	8.9	Lv,
	3959.6	8.5	M,	3978.6	8.9	Ca,
	3959.6	9.5	Ly,	3978.7	8.7	Hr,
	3959.7	8.9	Wf,	3981.6	8.6	Cd,
	3960.7	9.0	Lv,	3984.6	9.0	Ya.
	3961.7	8.7	Mi.			
123961 S URSAE MAJORIS—						
	3919.4	11.4	L,	3959.6	10.8	M,
	3928.6	11.7	Cy,	3959.6	10.3	B,
	3928.6	11.0	Ya,	3961.7	10.6	Mi,
	3937.4	11.3	L,	3963.6	10.6	Ly,
	3937.6	11.6	Hr,	3964.8	10.3	Sg,
	3937.6	11.7	Cy,	3965.7	10.5	Cy,
	3940.7	11.5	Kl,	3967.7	9.9	Hr,
	3944.7	11.4	Cy,	3967.7	10.0	Cy,
	3944.7	11.2	Hr,	3969.7	10.1	Mi,
	3952.6	11.0	Cd,	3970.6	9.6	Kl,
	3956.5	10.7	Ro,	3970.7	9.5	Ca,
	3956.7	11.0	Pt,	3974.6	9.0	Cy,
	3956.7	10.9	Mi,	3976.7	9.0	Sg,
	3958.5	10.7	Ro,	3978.6	8.9	Ca,
	3958.6	10.8	Mi,	3978.7	8.9	Hr,
	3959.6	10.8	Ly,	3984.6	8.9	Ya.
124204 RU VIRGINIS—						
	3937.7	12.6	Cy,	3956.7	12.5	Ft.
124606 U VIRGINIS—						
	3937.8	10.2	Cy,	3956.7	11.7	Pt.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
131283 U OCTANTIS—						
	3917.0	12.0	Bl.	3946.9	11.0	Bl,
	3923.9	11.7	Bl.	3962.1	10.2	Bl.
	3933.0	11.7	Bl,			
132002 W VIRGINIS—						
	3963.6	9.9	O.			
132202 V VIRGINIS—						
	3963.6	9.0	O.			
132422 R HYDRAE—						
	3902.0	5.6	Kd,	3930.1	5.7	Ch,
	3912.0	5.7	Kd,	3933.0	5.8	Bl,
	3915.0	5.6	Kd,	3933.1	6.0	Ch,
	3917.0	5.5	Bl,	3935.1	6.1	Ch,
	3918.0	5.6	Kd,	3936.4	6.4	L,
	3918.2	5.5	Ch,	3939.2	6.2	Ch,
	3919.0	5.7	Kd,	3941.2	6.3	Ch,
	3919.4	5.8	L,	3946.9	5.8	Bl,
	3928.4	5.7	L,	3956.7	6.5	Pt,
	3929.0	5.9	Kd,	3962.1	6.5	Bl.
	3929.1	5.7	Ch,			
132706 S VIRGINIS—						
	3932.6	8.1	Cy,	3959.5	8.7	Al,
	3933.8	8.1	Sg,	3962.6	8.8	Ca,
	3936.7	8.1	Em,	3964.7	9.1	Mi,
	3936.7	8.4	Hr,	3965.6	9.1	Mi,
	3936.7	8.4	Cy,	3966.7	9.1	Mi,
	3940.2	8.1	Ch,	3969.6	9.2	Mi,
	3946.7	8.5	Cy,	3974.6	9.2	Cy,
	3956.7	8.7	Pt,	3974.6	8.9	Al.
133155 RV CENTAURI—						
	3917.0	8.4	Bl.	3946.9	8.0	Bl,
	3923.9	7.9	Bl,	3962.1	7.7	Bl.
	3933.0	8.0	Bl,			
133273 T URSAE MINORIS—						
	3933.8	10.4	Lv,	3966.7	12.1	Wf,
	3942.7	10.7	Lv,	3968.7	11.7	Lv,
	3957.7	11.7	Lv,	3971.7	12.1	Wf,
	3959.7	12.0	Wf,	3977.7	12.2	Lv.
133633 T CENTAURI—						
	3915.0	7.8	Kd,	3933.0	7.2	Bl,
	3917.1	7.7	Bl,	3946.9	6.3	Bl,
	3962.1	6.5	Bl,	3924.0	7.7	Bl.
134236 RT CENTAURI—						
	3917.1	9.2	Bl,	3933.0	9.2	Bl.
	3923.9	9.1	Bl,			
134440 R CANUM VENATICORUM—						
	3933.8	10.2	Lv,	3959.6	11.7	M,
	3936.8	10.5	Cy,	3964.6	11.5	Ly,
	3942.6	10.3	Ya,	3964.8	10.8	Mi,
	3942.7	10.5	Lv,	3966.8	11.1	Mi,
	3946.7	10.7	Cy,	3967.7	11.8	Lv,
	3955.6	11.5	Ly,	3969.7	11.1	Mi,
	3956.7	10.4	Pt,	3976.6	11.6	Kl,
	3957.7	11.3	Lv,	3984.6	11.3	Ya.
134677 T APODIS—						
	3880.3	10.4	Sm,	3917.1	10.5	Bl,
	3886.3	10.4	Sm,	3923.9	11.4	Bl,
	3897.2	10.7	Sm,	3933.0	10.0	Bl.
	3903.2	10.7	Sm,			

VARIABLE STAR OBSERVATIONS, June 20 to July 20, 1924—Continued.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
135908 RR VIRGINIS—						
	3980.6	11.0	M.			
140113 Z BOOTIS—						
	3959.7	9.7	Wf,	3966.7	10.0	Wf,
	3966.6	10.4	M,	3971.7	10.2	Wf.
140512 Z VIRGINIS—						
	3956.7	12.8	Pt.			
140528 RU HYDRAE—						
	3880.3	7.9	Sm,	3904.2	9.3	Sm,
	3881.3	8.1	Sm,	3946.9	10.3	Bl,
	3886.3	8.3	Sm,	3962.1	11.1	Bl.
	3899.3	8.7	Sm,			
140959 R CENTAURI—						
	3880.3	10.7	Sm,	3946.9	11.0	Bl,
	3886.3	10.9	Sm,	3949.0	10.9	Bl,
	3899.2	10.7	Sm,	3962.0	10.7	Bl,
	3901.3	11.0	Sm,	3964.9	10.3	Bl.
141567 U URSAE MINORIS—						
	3918.2	9.8	Ch,	3956.7	11.2	Pt,
	3933.2	10.5	Ch,	3957.7	11.3	Lv,
	3933.8	10.5	Lv,	3968.7	11.4	Lv,
	3942.8	10.8	Lv,	3977.7	11.7	Lv.
	3943.2	10.6	Ch,			
141954 S BOOTIS—						
	3926.4	13.4	L,	3960.6	13.3	Pt.
142539 V BOOTIS—						
	3920.4	7.7	L,	3961.7	7.8	Mi,
	3927.6	7.8	Kl,	3962.7	8.0	Mi,
	3936.8	8.1	Cy,	3963.2	8.1	Ch,
	3940.4	7.8	L,	3963.7	8.3	Js,
	3944.7	7.8	Cy,	3963.7	8.0	Cy,
	3944.7	7.9	Hr,	3964.7	7.8	Ca,
	3954.6	7.9	Mi,	3964.7	7.8	Ly,
	3955.7	7.8	Mi,	3965.8	7.5	Sg,
	3956.5	7.7	Ro,	3969.7	7.9	Mi,
	3956.7	7.9	Mi,	3970.6	8.2	Cy,
	3957.7	8.0	Js,	3970.7	7.7	Ca,
	3958.5	7.7	Ro,	3974.7	7.8	Ly,
	3958.7	7.7	Ly,	3974.7	8.3	Js,
	3958.7	7.9	Ca,	3975.7	7.8	Mi,
	3959.5	7.6	Al,	3976.5	7.7	Ro,
	3959.7	7.6	Ly,	3985.6	8.0	Ya,
	3960.6	7.4	Pt,	3986.6	7.9	Ca.
142584 R CAMELOPARDALIS—						
	3951.8	11.0	Br,	3985.6	9.8	Ya.
	3970.8	10.4	Ca,			
143227 R BOOTIS—						
	3914.1	8.1	Ch,	3963.2	8.1	Ch,
	3931.7	7.1	Sg,	3964.8	8.2	Mi,
	3935.1	6.8	Ch,	3965.8	7.0	Sg,
	3937.8	7.0	Cy,	3966.8	8.4	Mi,
	3940.6	8.3	Cy,	3968.8	8.3	Mi,
	3958.7	7.5	Ca,	3969.7	8.3	Mi,
	3959.5	8.0	Al,	3975.7	8.5	Mi,
	3959.6	8.2	M,	3985.6	9.0	Ya,
	3960.6	7.0	Pt,	3986.6	8.6	Ca.
143417 V LIBRAE—						
	3958.6	12.1	B.			
144918 U BOOTIS—						
	3946.7	10.4	Cy,	3974.7	11.3	Cy.
	3959.6	10.9	M,			
145254 Y LUPI—						
	3881.2	9.9	Sm,	3923.9	10.7	Bl,
	3888.2	10.0	Sm,	3933.0	10.8	Bl,
	3899.2	10.1	Sm,	3946.9	11.1	Bl,
	3904.2	10.3	Sm,	3962.1	12.2	Bl.
	3917.1	10.5	Bl,			
145971 S APODIS—						
	3908.1	10.7	Bl,	3946.9	12.8	Bl,
	3917.1	11.0	Bl,	3949.0	12.8	Bl,
	3923.9	12.1	Bl,	3956.9	12.8	Bl,
	3926.0	12.4	Bl,	3962.0	12.7	Bl,
	3933.0	12.9	Bl,	3964.9	12.7	Bl.
	3934.9	12.7	Bl,			
150018 RT LIBRAE—						
	3960.6	13.2	Pt.			
150519 T LIBRAE—						
	3958.6	11.7	B,	3960.6	12.0	Pt.
150605 Y LIBRAE—						
	3920.4	8.9	L,	3960.6	10.3	Pt,
	3940.4	9.2	L,	3984.6	11.5	Ya.
151520 S LIBRAE—						
	3920.4	8.4	L,	3946.2	8.6	Ch,
	3929.2	8.5	Ch,	3960.6	8.6	Pt,
	3935.1	8.6	Ch,	3984.6	9.6	Ya.
151714 S SERPENTIS—						
	3928.4	12.0	L,	3966.7	11.7	Wf,
	3959.8	11.6	Wf,	3972.7	11.4	Wf,
	3960.6	11.5	Pt,	3984.6	11.1	Ya.
	3962.7	11.6	Ca,			
151731 S CORONAE BOREALIS—						
	3941.7	11.3	Cy,	3962.7	12.2	Ca,
	3959.7	12.4	M,	3965.8	12.0	Sg.
151822 RS LIBRAE—						
	3881.3	9.4	Sm,	3924.0	10.5	Bl,
	3891.4	9.9	Sm,	3933.0	11.1	Bl,
	3899.3	10.2	Sm,	3949.0	11.4	Bl,
	3904.3	10.2	Sm,	3958.6	11.4	B,
	3917.1	10.4	Bl,	3962.1	11.4	Bl.
	3920.4	10.7	L,			
152714 RU LIBRAE—						
	3920.4	11.3	L,	3960.6	12.8	Pt.
	3958.6	12.8	B,			
152849 R NORMAE—						
	3880.1	9.1	Sm,	3924.0	6.8	Bl,
	3886.3	9.0	Sm,	3926.0	6.7	Bl,
	3897.3	8.3	Sm,	3933.1	7.2	Bl.
	3903.2	8.0	Sm,	3946.9	7.6	Bl,
	3908.1	7.8	Bl,	3962.1	8.2	Bl.
	3917.1	7.5	Bl,			
153020 X LIBRAE—						
	3933.1	13.3	Bl.			
153215 W LIBRAE—						
	3930.4	13 7	L,	3935.4	14.1	L.
	3933.1	13.3	Bl,			

VARIABLE STAR OBSERVATIONS, June 20 to July 20, 1924—Continued.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
153378 S URSAE MINORIS—						
	3937.7	8.8	Cy,	3964.6	9.5	Al,
	3946 8	8.9	Cy,	3965.8	9.4	Sg,
	3951.7	10.4	Sg,	3974.7	10.0	Cy,
	3956.5	9.1	Ro,	3976.5	9 8	Ro,
	3958.5	9.3	Ro,	3977.7	9.9	Kl,
	3958.7	8.9	Ca,	3978.7	9.5	Ca,
	3960.6	8.8	Pt,	3985.6	9.6	Ya.
	3963.7	9.2	Cy,			
153620 U LIBRAE—						
	3908.1	11.8	Bl,	3933.1	10.4	Bl,
	3917.1	10.6	Bl,	3949.0	9.8	Bl,
	3924.0	10.5	Bl,	3964.9	10.6	Bl.
	3926.0	10.2				
153654 T NORMAE—						
	3901.3	11.9	Sm.			
154428 R CORONAE BOREALIS—						
	3902.1	6.1	Kd,	3960.6	6.1	Pt,
	3907.1	6.2	Kd,	3961.5	6.2	Al,
	3909.6	6.1	L,	3961.7	6.0	Wf,
	3912.0	6.3	Kd,	3962.6	5.8	Kl,
	3915.2	6.2	Ch,	3962.7	6.0	Ca,
	3918.0	6.4	Kd,	3962.7	6.1	Mi,
	3919.5	6.2	L,	3962.7	6.1	Pt,
	3921.4	6.0	L,	3963.1	6.4	Ln,
	3927.6	5.7	Kl,	3963.2	6.0	Ch,
	3928.4	6.0	L,	3963.7	5.7	Js,
	3928.6	6.1	Cy,	3963.7	6.2	Cy,
	3928.6	5.7	Kl,	3963.7	5.8	Ly,
	3929.0	6.3	Kd,	3963.7	6.0	Wf,
	3929.1	6.3	Ch,	3964.6	6.1	Pt,
	3930.1	6.4	Ln,	3964.7	5.9	Ca,
	3930.2	6.2	Ch,	3964.8	6.1	Wf,
	3930.7	6.0	Kl,	3964.8	6.0	Sg,
	3931.2	6.2	Ch,	3965.7	6.2	Cy,
	3931.7	6.2	Sg,	3965.8	6.1	Pt.
	3932.7	6.3	Cy,	3965.8	6.0	Wf,
	3933.2	6.2	Ch,	3966.5	6.0	L,
	3933.6	6.0	Kl,	3966.6	6.0	M,
	3934.2	6.1	Ch,	3966.7	6.2	Pt,
	3935.1	6.1	Ch,	3966.8	6.0	Gb,
	3935.5	5.9	L,	3966.8	6.1	Wf,
	3935.7	5.9	Kl,	3967.6	6.1	Ca,
	3936.4	6.0	L,	3967.7	5.4	Js,
	3936.7	6.2	Hr,	3967.8	6.1	Wf,
	3936.7	6.2	Em,	3967.8	6.2	Pt,
	3936.7	6.2	Cy,	3968.6	6.2	Pt,
	3937.7	6.1	Cd,	3969.6	6.0	Ca,
	3937.7	6.3	Cy,	3970.6	6.2	Cy,
	3940.3	6.0	Ch,	3970.6	6.2	Ca,
	3940.7	5.7	Kl,	3970.7	6.0	Kl,
	3941.7	6.2	Cy,	3970.7	6.0	Mi,
	3942.1	6.0	Ln,	3970.7	6.2	Pt,
	3942.7	5.9	Kl,	3970.8	6.1	Wf,
	3943.6	6.0	Cd,	3971.6	6.2	Pt,
	3944.6	6.2	Cm,	3972.6	6.2	Pt,
	3944.7	6.2	Cy,	3972.8	6.1	Wf,
	3944.8	6.2	Hr,	3973.6	6.2	Cy,
	3945 1	6.0	Ch,	3973.8	6.1	Wf,
154428 R CORONAE BOREALIS—Continued.						
	3947.7	6.2	Cy,	3974.7	6.0	Ly,
	3948.8	6.0	Wf,	3974 7	6.2	Wf,
	3950 8	6.2	Sg,	3974.7	6.3	Cy,
	3951.6	6.1	Cm,	3974.7	5.6	Js,
	3951.8	6.0	Wf,	3975.7	6.0	Wf,
	3952.8	6.0	Wf,	3976.5	5.8	Ro,
	3953.6	6 0	Cd,	3976.7	6.3	Cy,
	3955.7	5.9	Ly,	3977.6	6.1	Pt,
	3955.7	6.1	Pt,	3977.7	6.2	Kl.
	3955.7	6.1	Mi,	3977.7	6.2	Wf,
	3956.5	6.1	Ro,	3978.7	6.0	Ca,
	3956.6	6.0	Js,	3979.7	6.2	Pt,
	3956.7	6.1	Pt,	3980.6	6.2	M,
	3956.7	6.0	Kl,	3980.7	6.0	O,
	3958.1	6.1	Ch,	3981.6	6.1	Pt,
	3958.5	6.0	Ro,	3981.7	5.5	Sg,
	3958.6	6.0	Ca,	3981.7	5.8	Kl,
	3958.7	5.4	Ly,	3981.7	6.0	Ca,
	3958.7	6.0	Wf,	3982.7	6.2	Pt,
	3958.8	6.2	Pt,	3983.6	6.1	Pt,
	3959.6	6.2	Cm,	3984.6	6.0	Cm,
	3959.6	6.0	Al,	3984.7	6.0	Kl,
	3959 6	5.6	Ly,	3985.6	6.0	Ya,
	3959.8	6.2	Wf,	3986.6	5.9	Ca,
	3959.7	6.0	Ca,	3992.7	5.8	Cm.
154536 X CORONAE BOREALIS—						
	3959.8	10.3	Wf,	3966.8	11.2	Wf,
	3960.6	9.8	Pt.	3971.7	11.4	Wf.
154615 R SERPENTIS—						
	3929.1	8 6	Ch,	3961.7	10.0	Mi,
	3935.1	9.0	Ch,	3962.8	10.3	Mi,
	3941.7	9.3	Cy,	3966.7	10.5	Mi,
	3945.1	9.1	Ch,	3967.7	10.6	Ca,
	3948.6	9.7	Ya,	3969.8	11.0	Mi,
	3955.6	10.3	Mi,	3974.7	10.8	Cy,
	3955.8	10.3	Mi,	3981.6	11.0	Kl.
	3960.6	10.2	Pt,			
154639 V CORONAE BOREALIS—						
	3937.7	10.1	Br,	3966.8	9.3	Wf,
	3959.7	9 6	M.	3967.7	8.8	Ca,
	3959.8	9.6	Wf,	3972.7	9.5	Wf,
	3960.6	8.5	Pt,	3985.6	9.2	Ya.
154715 R LIBRAE—						
	3958.6	11.0	B,	3984.6	10.0	Ya.
155018 RR LIBRAE—						
	3935.4	14.1	L.			
155229 Z CORONAE BOREALIS—						
	3937.8	10.9	Br.			
155823 RZ SCORPIONIS—						
	3899.3	12.0	Sm,	3960.6	9.5	Pt.
	3904.3	11.5	Sm,			
160021 Z SCORPII—						
	3917.1	12.5	Bl,	3964.9	12.5	Bl.
	3935.4	12.2	L,			
160118 R HERCULIS—						
	3934.8	13.8	Sg.			

VARIABLE STAR OBSERVATIONS, June 20 to July 20, 1924—Continued.

Star	J.D.	Est.Obs.	J.D.	Est.Obs.
160210 U SERPENTIS—				
	3934.8	12.4 Sg,	3970.7	9.6 Kl,
	3960.6	10.9 Pt,	3980.7	9.2 M,
	3962.7	10.6 Ca,	3984.6	9.2 Ya.
	3970.6	10.0 Cy,		
160221a X SCORPII—				
	3917.1	10.5 Bl,	3933.1	11.3 Bl,
	3924.0	10.1 Bl,	3949.0	12.0 Bl,
	3926.0	10.6 Bl,	3964.9	12.9 Bl.
160519 W SCORPII—				
	3917.1	11.9 Bl,	3933.1	11.9 Bl.
160625a RU HERCULIS—				
	3935.5	12.3 L,	3961.7	8.5 Wf,
	3959.6	9.2 M,	3963.7	9.0 Wf,
	3959.8	9.1 Wf,	3971.7	8.8 Wf,
	3960.6	9.4 Pt,	3985.7	9.5 Ya.
160625b SX HERCULIS—				
	3929.4	7.6 L,	3966.7	8.4 Pt,
	3936.6	7.9 L,	3967.8	8.6 Pt,
	3955.7	8.1 Pt,	3968.6	8.6 Pt,
	3956.7	8.0 Pt,	3970.7	8.3 Pt,
	3959.8	8.2 Wf,	3971.6	8.2 Pt,
	3960.6	8.0 Pt,	3971.7	8.6 Wf,
	3961.7	8.4 Wf,	3972.6	8.4 Pt,
	3962.7	8.2 Pt.	3977.6	8.9 Pt,
	3963.7	8.8 Wf,	3979.7	9.1 Pt,
	3964.6	8.3 Pt,	3982.7	9.0 Pt,
	3965.8	8.3 Pt,	3983.7	8.9 Pt.
161122a R SCORPII—				
	3881.4	10.5 Sm,	3933.1	12.0 Bl,
	3891.4	10.2 Sm,	3949.0	12.8 Bl,
	3899.3	10.5 Sm,	3962.6	13.4 Pt,
	3904.3	10.5 Sm,	3964.9	13.4 Bl.
	3917.1	11.3 Bl,		
161122b S SCORPII—				
	3881.4	11.9 Sm.		
161138 W CORONAE BOREALIS—				
	3959.7	11.1 M,	3962.8	10.9 Ca.
	3962.6	10.8 Pt,		
161607 W OPHIUCHI—				
	3935.5	14.1 L.		
162112 V OPHIUCHI—				
	3962.6	8.1 Pt,	3970.6	8.6 Ca.
162119 U HERCULIS—				
	3920.2	7.3 Ch,	3963.6	8.4 Js,
	3945.6	8.0 Js,	3967.7	9.4 Js.
	3954.9	8.2 Mi,	3969.8	9.0 Mi,
	3955.8	8.5 Mi,	3972.7	8.8 Js,
	3956.6	8.1 Js,	3974.6	8.6 Js.
	3956.8	8.6 Mi,	3975.8	8.9 Mi,
	3958.6	7.9 Ca,	3978.6	8.8 Ca,
	3959.6	8.8 Cm,	3981.6	9.1 Js,
	3961.7	8.9 Mi,	3985.6	8.9 Ya,
	3962.6	8.1 Pt.	3992.7	9.0 Cm.
	3962.7	9.0 Mi.		
162807 SS HERCULIS—				
	3928.4	12.1 L,	3985.6	9.8 Ya.
	3962.6	9.9 Pt,		
162815 T OPHIUCHI—				
	3917.1	10.5 Bl,	3933.1	11.6 Bl,
	3921.6	11.1 L,	3949.1	11.6 Bl.
	3924.0	10.5 Bl,	3964.9	11.6 Bl.
163137 W HERCULIS—				
	3940 3	11.5 Ch,	3962.6	11.0 Pt,
	3945.1	11.5 Ch,	3967.7	9.2 Ca.
	3959.7	10.8 M,		
163266 R DRACONIS—				
	3918.2	7.9 Ch,	3951.8	9.9 Br,
	3932.2	9.0 Ch,	3962.6	10.6 Pt,
	3943.2	9.6 Ch,	3967.8	10.7 Ca,
164055 S DRACONIS—				
	3980.7	8.2 M.		
164319 RR OPHIUCHI—				
	3881.4	9.8 Sm,	3921.6	10.8 L,
	3891.4	9.8 Sm,	3958.6	12.5 B,
	3901.3	10.0 Sm,	3962.6	12.0 Pt.
164715 S HERCULIS—				
	3932.2	9.5 Ch,	3967.9	8.8 Mi,
	3945.1	9 3 Ch,	3968 8	8.8 Mi,
	3958.6	8.5 Ca,	3969.6	8.4 Ca,
	3959.7	8.6 M,	3969.8	8.8 Mi,
	3961.6	9.2 O,	3978.7	7.9 Ca,
	3962.6	8.6 Pt,	3985.6	8.5 Ya.
	3964.7	8.5 Ca,		
164844 RS SCORPII—				
	3881.3	8.4 Sm,	3924.0	7.0 Bl,
	3891.4	7.2 Sm,	3934.2	6.9 Bl,
	3899.3	6.3 Sm,	3949.1	7.2 Bl,
	3904.3	6.3 Sm,	3964.9	7.8 Bl.
	3917.1	7.1 Bl,		
165030 RR SCORPII—				
	3917.1	6.2 Bl,	3949.1	6.2 Bl,
	3924.0	6.3 Bl,	3964.9	6.5 Bl.
	3934.2	5.8 Bl,		
165202 SS OPHIUCHI—				
	3935.8	12.3 Br.		
165631 RV HERCULIS—				
	3934.8	10.5 Sg,	3962.6	13.0 Pt,
	3957.7	13.5 Lv,	3970.7	12.2 Lv,
	3958.6	13.6 B,	3980.7	11.6 Lv.
	3960.7	13.3 Lv,		
165636 RT SCORPII—				
	3934.2	14.3 Bl,	3964.9	12.3 Bl.
170215 R OPHIUCHI—				
	3932.2	9.8 Ch,	3962.6	7.8 Pt,
	3937.8	9.3 Cy,	3962.7	8 2 Mi.
	3940.2	9.2 Ch,	3963.2	7.6 Ch,
	3942.7	9.5 Kl,	3963.6	8.2 Js,
	3945.1	8.9 Ch,	3964.7	8.0 Ca,
	3946.7	8.9 Cy,	3968.7	8.0 Mi,
	3955.8	8.4 Mi,	3969.6	7.7 Ca,
	3956.6	8.6 Js,	3970.7	7.9 Kl,
	3956.8	8.5 Mi,	3970.7	8.2 Cy,
	3958.7	8.3 Ly,	3974.6	7.6 Js,
	3959.6	8.4 Al,	3974.7	8.0 Ly,
	3959.7	8.0 M,	3978.6	7.5 Ca,
	3962.6	8.2 Ly,	3986.7	8.0 Al.

VARIABLE STAR OBSERVATIONS, June 20 to July 20, 1924—Continued.

Star	J.D.	Est.Obs.	J.D.	Est.Obs.
170627 RT HERCULIS—				
	3948.6	10.2 Ya,	3965.7	10.7 Wf,
	3960.8	10.7 Wf,	3971.7	10.7 Wf,
	3962.6	11.1 Pt,		
170833 RW SCORPII—				
	3917.1	9.2 Bl,	3933.1	9.7 Bl,
	3924.0	9.7 Bl,	3949.1	10.9 Bl,
	3926.0	9.6 Bl,	3964.9	11.0 Bl.
171401 Z OPHIUCHI—				
	3962.6	12.6 Pt,	3964.9	12.2 Mi,
	3962.6	12.6 Ca,	3967.7	12.6 Mi.
171723 RS HERCULIS—				
	3927.7	11.0 Kl,	3965.7	12.4 Wf,
	3960.8	12.5 Wf,	3971.7	12.4 Wf.
	3962.6	12.3 Pt,		
172486 S OCTANTIS—				
	3917.1	9.5 Bl,	3949.1	10.3 Bl,
	3924.0	9.6 Bl,	3964.9	11.0 Bl.
	3934.2	10.1 Bl,		
173212 RT SERPENTIS—				
	3940.5	9.4 L.		
173543 RU SCORPII—				
	3917.1	11.8 Bl,	3949.1	11.1 Bl,
	3924.0	11.6 Bl,	3964.9	10.8 Bl.
	3934.2	12.0 Bl,		
174135 SV SCORPII—				
	3908.1	12.7 Bl,	3934.3	11.3 Bl,
	3917.1	11.9 Bl,	3949.1	10.7 Bl.
	3924.0	11.6 Bl,	3965.0	10.4 Bl.
174162 W PAVONIS—				
	3917.1	13.5 Bl,	3933.1	10.2 Bl,
	3924.0	11.6 Bl,	3949.1	9.1 Bl,
	3926.1	11.5 Bl,	3965.0	8.9 Bl.
174551 U ARAE—				
	3880.4	9.1 Sm,	3899.3	10.4 Sm,
	3886.3	9.5 Sm,	3904.3	10.8 Sm.
175111 RT OPHIUCHI—				
	3935.8	11.5 Br,	3962.7	12.0 Pt.
175458a T DRACONIS—				
	3933.2	11.0 Ch.		
175458b UY DRACONIS—				
	3933.2	12.2 Ch.		
175519 RY HERCULIS—				
	3932.2	9.6 Ch,	3960.8	8.7 Lv,
	3933.8	9.5 Lv,	3962.7	8.8 Pt,
	3935.8	9.7 Br,	3970.7	8.9 Lv,
	3945.1	9.0 Ch,	3980.7	9.2 Lv.
	3959.7	9.0 M,		
175654 V DRACONIS—				
	3951.9	13.0 Br,	3962.7	13.0 Pt.
180363 R PAVONIS—				
	3881.3	8.7 Sm,	3899.3	10.3 Sm,
	3888.3	8.7 Sm,	3904.3	10.6 Sm.
180531 T HERCULIS—				
	3921.6	11.6 L,	3969.8	10.8 Mi,
	3958.6	11.8 Ca,	3970.8	10.7 Ca,
	3961.8	11.0 Mi,	3978.8	9.6 Ca,
	3962.7	11.0 Pt,	3985.7	9.5 Ya.
180565 W DRACONIS—				
	3962.7	11.8 Pt,	3970.8	10.9 Lv,
	3963.7	12.1 Lv,	3980.8	10.1 Lv.
180666 X DRACONIS—				
	3935.8	13.5 Lv,	3970.8	13.7 Lv.
	3963.7	13.8 Lv,		
180911 NOVA OPHIUCHI #4—				
	3962.7	13.6 Pt.		
181031 TV HERCULIS—				
	3921.6	9.4 L,	3940.5	9.1 L.
181103 RY OPHIUCHI—				
	3935.8	14.0 Br,	3962.7	12.3 Pt,
	3935.8	13.7 Lv,	3966.7	11.2 Lv,
	3960.8	11.8 Lv,	3969.6	11.4 Ca,
	3961.6	12.0 O,	3972.8	10.7 Lv.
181136 W LYRAE—				
	3921.6	9.6 L,	3964.6	10.0 Pt,
	3932.8	11.0 Sg,	3967.9	10.3 Mi,
	3940.6	10.4 L,	3968.9	10.1 Mi,
	3940.6	10.9 Kl,	3975.6	9.9 Mi,
	3955.6	10.7 Mi,	3976.6	9.7 Kl,
	3958.6	10.8 Ca,	3977.6	9.8 Ca,
	3961.7	10.7 Mi,	3978.8	10.2 Ca,
	3962.6	10.7 Mi,	3986.7	9.6 Ca.
182133 RV SAGITTARII—				
	3917.1	8.3 Bl,	3949.1	9.6 Bl,
	3924.0	8.1 Bl,	3965.0	10.9 Bl.
	3934.3	9.1 Bl,		
182224 SV HERCULIS—				
	3921.6	9.6 L,	3940.6	9.8 L.
	3935.8	10.7 Br,		
182306 T SERPENTIS—				
	3935.8	12.7 Br.		
183149 SV DRACONIS—				
	3965.8	12.3 Br.		
183225 RZ HERCULIS—				
	3935.8	13.7 Br.		
183308 X OPHIUCHI—				
	3924.6	8.2 L,	3961.6	8.6 O,
	3937.8	8.0 Cy,	3964.6	8.6 Ly,
	3940.6	8.3 L,	3964.6	8.3 Pt,
	3946.8	8.6 Cy,	3970.7	9.0 Cy,
	3958.7	8.8 Ly,	3974.7	9.0 Cy.
184205 R SCUTI—				
	3881.6	8.2 Sl,	3958.7	5.3 Ly,
	3883.1	5.7 Nk,	3959.7	5.2 Ca,
	3902.0	5.8 Kd,	3961.8	5.4 Mi,
	3907.4	5.7 Kd,	3962.6	5.8 O,
	3908.6	5.9 L,	3962.6	5.3 Ca,
	3919.3	5.7 Kd,	3962.7	5.3 Mi,
	3921.6	5.3 L,	3963.7	5.5 Ly,
	3924.6	5.3 L,	3963.8	5.3 Cy,
	3927.7	5.2 Kl,	3964.5	5.6 Ro,
	3928.8	4.9 Cy,	3964.7	5.4 Ca,
	3930.7	5.2 Kl,	3965.7	5.1 Cy,
	3931.2	5.6 Ch,	3967.6	5.1 Ca,
	3935.7	5.4 Kl,	3966.7	5.5 Gb,
	3936.6	5.0 L,	3968.6	5.1 Kl,
	3936.8	5.5 Cy,	3968.8	5.0 M,
	3937.7	5.5 Cd,	3969.6	5.6 Ca,

VARIABLE STAR OBSERVATIONS, June 20 to July 20, 1924—Continued.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
184205 R SCUTI—Continued.						
	3940.6	5.1	L,	3969.7	5.3	Mi,
	3940.7	5.2	Kl,	3970.6	5.6	Ca,
	3941.8	5.3	Cy,	3970.6	5.1	Cy,
	3942.7	5.2	Kl,	3973.7	5.1	Cy,
	3943.8	5.3	Sg,	3974.7	5.5	Cy,
	3944.8	5.6	Cy,	3976.5	5.5	Ro,
	3944.8	5.6	Hr,	3976.6	5.4	Kl,
	3946.8	5.6	Cy,	3976.7	5.6	Cy,
	3952.6	5.0	Cd,	3978.6	5.5	Ca,
	3953.6	5.1	Cd,	3981.7	4.8	Js,
	3956.5	5.7	Ro,	3981.7	5.6	Ca,
	3956.9	5.3	Mi,	3984.7	5.4	Kl,
	3958.5	5.7	Ro,	3985.7	5.5	Ya,
	3958.6	5.2	Ca,	3986.6	5.6	Ca,
	3958.7	5.2	Kl,	3992.7	5.8	Cm.
184243 RW LYRAE—						
	3964.6	13.6	Pt.			
184300 NOVA AQUILAE #3—						
	3906.2	10.4	Nk,	3967.8	10.2	Pt,
	3931.2	10.4	Ch,	3969.6	10.3	Ca,
	3940.7	10.5	Kl,	3971.6	10.8	Pt,
	3956.5	10.7	Ro,	3976.5	10.7	Ro,
	3956.7	10.8	Pt,	3976.7	10.4	Kl,
	3958.5	10.6	Ro,	3977.6	10.6	Pt.
	3964.5	10.7	Ro,			
185032 RX LYRAE—						
	3959.7	11.5	M,	3964.6	12.8	Pt.
185437 S CORONAE AUSTRALIS—						
	3917.1	11.8	Bl,	3949.1	12.1	Bl,
	3933.1	11.8	Bl,	3965.0	12.1	Bl.
185512a ST SAGITTARII—						
	3924.6	10.3	L,	3940.6	11.6	L.
	3931.2	11.2	Ch,			
185537a R CORONAE AUSTRALIS—						
	3908.1	12.8	Bl,	3949.1	11.9	Bl,
	3917.1	12.0	Bl,	3965.0	13.0	Bl.
	3933.1	12.1	Bl,			
185537b T CORONAE AUSTRALIS—						
	3908.1	13.6	Bl,	3965.0	13.5	Bl.
185634 Z LYRAE—						
	3926.4	12.1	L,	3964.6	13.1	Pt.
	3937.8	13.3	Br,			
185737 RT LYRAE—						
	3937.8	12.6	Br.			
185905 V AQUILAE—						
	3881.6	7.8	Sl.			
190108 R AQUILAE—						
	3932.2	8.8	Ch,	3964.6	10.0	Pt,
	3959.7	10.5	M,	3970.6	10.8	Ca.
190529a V LYRAE—						
	3964.6	10.4	Pt,	3968.8	11.2	M.
190819a RW SAGITTARII—						
	3931.3	9.7	Ch,	3964.6	9.5	Pt.
190907 TY AQUILAE—						
	3940.7	10.5	Kl,	3970.7	10.7	Ca.
	3964.6	10.3	Pt,			
190925 S LYRAE—						
	3960.8	14.0	Lv,	3970.8	14.0	Lv.
190926 X LYRAE—						
	3964.6	9.0	Pt.			
190933a RS LYRAE—						
	3932.2	10.8	Ch,	3964.6	10.9	Pt,
	3935.9	10.8	Lv,	3965.8	11.0	Br,
	3959.6	10.8	M,	3970.8	10.9	Lv.
	3960.8	11.0	Lv,			
190967a U DRACONIS—						
	3951.9	11.9	Br,	3964.6	11.6	Pt.
191007 W AQUILAE—						
	3940.2	8.2	Ch,	3964.6	9.3	Pt,
	3940.7	8.5	Kl,	3970.7	8.9	Ca.
191017 T SAGITTARII—						
	3931.3	10.3	Ch,	3964.6	8.4	Pt.
	3940.3	9.6	Ch,			
191019 R SAGITTARII—						
	3964.6	9.7	Pt,	3970.7	9.5	Ca.
191033 RY SAGITTARII—						
	3903.4	9.2	Sm,	3936.6	9.2	L,
	3908.1	9.4	Bl,	3940.3	9.3	Ch,
	3910.6	10.1	L,	3940.6	9.5	L,
	3917.1	9.5	Bl,	3949.1	9.5	Bl,
	3921.6	9.8	L,	3962.0	9.2	Bl,
	3924.0	9.3	Bl,	3965.0	9.0	Bl,
	3926.1	9.2	Bl,	3965.8	9.4	Pt,
	3933.1	9.1	Bl,	3966.5	9.5	L,
	3934.3	9.3	Ch,	3967.8	10.1	Pt,
	3935.5	9.2	L,	3970.7	9.1	Pt.
191319 S SAGITTARII—						
	3908.1	13.0	Bl,	3934.2	13.9	Bl.
191331 SW SAGITTARII—						
	3908.1	11.0	Bl,	3934.3	12.4	Bl,
	3917.1	11.6	Bl,	3965.0	13.3	Bl.
191350 TZ CYGNI—						
	3962.6	10.7	O,	3964.6	10.5	Pt.
191637 U LYRAE—						
	3964.6	10.0	Pt.			
192928 TY CYGNI—						
	3937.8	13.5	Br,	3962.6	12.2	O,
	3959.6	12.0	M,			
193311 RT AQUILAE—						
	3931.2	8.5	Ch,	3968.8	10.0	M,
	3964.6	9.8	Pt,	3970.8	10.0	Br.
	3967.6	10.1	O,			
193449 R CYGNI—						
	3935.8	12.6	Lv,	3963.7	11.2	Lv,
	3936.7	13.0	Cy,	3964.9	11.3	Mi,
	3936.7	13.0	Em,	3965.8	11.3	Pt,
	3936.7	13.0	Hr,	3966.6	11.2	Mi,
	3937.8	12.5	Br,	3966.7	11.2	Lv,
	3939.8	12.5	Lv,	3969.9	11.0	Mi,
	3944.7	12.3	Hr,	3970.6	11.2	Kl,
	3944.7	12.3	Cy,	3970.7	10.6	Cy,
	3946.7	12.3	Cy,	3972.7	10.6	Lv,
	3957.7	11.4	Lv,	3974.6	10.5	Al,
	3958.7	11.8	Mi,	3974.7	10.7	Lv,
	3958.8	11.5	Sg,	3975.7	10.9	Mi,
	3959.6	11.4	M,	3976.7	10.4	Cy,
	3961.7	10.9	Lv,	3977.6	10.4	Al,
	3963.7	11.2	Cy,	3978.6	9.9	Ca.

VARIABLE STAR OBSERVATIONS, June 20 to July 20, 1924—Continued.

Star	J.D.	Est.Obs.	J.D.	Est.Obs.
193972 T PAVONIS—				
	3881.3	12.5 Sm,	3934.2	13.5 Bl,
	3908.1	13.4 Bl,	3965.0	12.4 Bl.
194048 RT CYGNI—				
	3918 3	9.8 Ch,	3958.8	11.9 Sg,
	3932.8	11.5 Sg,	3959.6	11.5 M,
	3937.8	11.5 Br,	3965.8	11.6 Pt,
	3944.7	11.2 Cy,	3970.7	11.3 Kl,
	3946.8	12.0 Cy,	3976.7	11.0 Cy.
194348 TU CYGNI—				
	3918.3	9.4 Ch,	3943.3	10.0 Ch,
	3931.3	9.7 Ch,	3959.6	11.4 M,
	3935.8	10.3 Lv,	3965.8	11.8 Pt.
	3937.8	10.5 Br,		
194604 X AQUILAE—				
	3960.8	14.6 Wf,	3972.8	14.5 Wf,
	3965.7	14.4 Wf,	3977.8	14.6 Wf.
	3967.8	14.5 Wf,		
194632 χ CYGNI—				
	3937.8	12.4 Br,	3970.8	13.3 Br.
	3965.8	13.2 Pt,		
194930 RR SAGITTARII—				
	3908.1	12.5 Bl,	3965.0	12.9 Bl.
	3934.3	13.3 Bl,		
195142 RU SAGITTARII—				
	3903.4	7.0 Sm,	3934.3	7.8 Bl,
	3908.1	7.1 Bl,	3949.1	8.1 Bl,
	3917.1	7.1 Bl,	3965.0	8.8 Bl.
	3926.1	7.1 Bl,		
195202 RR AQUILAE—				
	3962.6	9.0 O,	3984.6	9.4 O.
	3965.8	9.3 Pt,		
195553 NOVA CYGNI #3—				
	3955.7	11.2 Pt,	3968.6	11.5 Pt,
	3958.5	11.0 Ro,	3970.7	11.2 Pt,
	3960.6	11.2 Pt,	3976.5	11.3 Ro,
	3962.7	11.2 Pt,	3977.6	11.2 Pt,
	3964.5	11.0 Ro,	3977.6	12.0 Kl,
	3966.7	11.2 Pt,	3982.7	11.2 Pt.
195849 Z CYGNI—				
	3937.9	11.2 Br,	3965.7	9.6 Wf,
	3959.6	10.0 M.	3965.8	9.8 Pt,
	3960.8	10.1 Wf,	3972.8	9.5 Wf.
195855 S TELESCOPII—				
	3908.1	12.8 Bl,	3965.0	12 8 Bl.
	3934.3	12.7 Bl,		
200212 SY AQUILAE—				
	3910.6	11.0 L,	3965.8	12.0 Pt.
	3937.9	11.8 Br,		
200514 R CAPRICORNI—				
	3965.8	12.0 Pt,	3974.8	12.2 Lv.
	3966.7	12.0 Lv,		
200715a S AQUILAE—				
	3959.6	10.7 M,	3965.8	9.8 Pt.
200715b RW AQUILAE—				
	3965.8	9.3 Pt.		
200747 R TELESCOPII—				
	3908.2	14.0 Bl.		
200812 RU AQUILAE—				
	3966.8	13.1 Lv.		
200822 W CAPRICORNI—				
	3908.2	11.3 Bl,	3934.3	13 2 Bl.
	3917.1	11.8 Bl,		
200906 Z AQUILAE—				
	3965.8	10.1 Pt.		
200938 RS CYGNI—				
	3926.4	7.1 L,	3950.8	7.2 Sg,
	3918.3	7.3 Ch,	3958.7	8.3 Ly,
	3928.7	8 2 Cy,	3959.6	7.5 Al,
	3931.3	7.3 Ch,	3962.2	8.2 Ch,
	3932.3	7.2 Ch,	3962.7	8.0 Ly,
	3932.8	7.0 Sg,	3963.7	7.9 Cy,
	3937.7	7.8 Cy,	3965.8	7.4 Pt,
	3940 3	7.3 Ch,	3970.7	8.4 Cy,
	3943.3	7.4 Ch,	3974.5	7.8 Al,
	3944.7	8.2 Cy,	3978.7	7.6 Cy,
	3944.7	8.0 Hr,	3981.7	8.2 Js,
	3946.2	7.6 Ch,	3986.7	7.8 Al.
201008 R DELPHINI—				
	3910 6	12.1 L,	3965.8	13.4 Pt.
	3937.9	13.0 Br,		
201121 RT CAPRICORNI—				
	3965.8	6.3 Pt.		
201130 SX CYGNI—				
	3937.9	9.5 Br,	3965.8	8.6 Pt.
	3948.6	9.2 Ya,		
201139 RT SAGITTARII—				
	3908.2	12.9 Bl,	3949.1	10.8 Bl,
	3934.3	12.4 Bl,	3965.0	9.6 Bl.
201437b WX CYGNI—				
	3937.8	11.5 Cy,	3963.7	11.5 Cy,
	3937.9	11.5 Br,	3963.8	11.6 Lv,
	3939.8	11.4 Lv,	3965.8	11.5 Pt,
	3939.8	11.4 Lv,	3970.6	11.6 Kl,
	3944.8	11.4 Cy,	3977.7	10.9 Cy.
201647 U CYGNI—				
	3950.8	8.8 Sg,	3966.6	9.6 Mi,
	3956.5	8.3 Ro,	3969.6	8.5 Ca,
	3958.5	8.2 Ro,	3969.7	9.6 Mi,
	3959.6	9.7 M,	3975.6	9.6 Mi,
	3964.5	8.4 Ro,	3976.5	8 3 Ro,
	3964.6	9.5 Mi,	3980.6	9.0 O,
	3965.7	9.7 Mi,	3981.6	8.2 Al.
	3965.8	8.2 Pt,		
202240 U MICROSCOPII—				
	3908.2	12.3 Bl,	3934.3	13.0 Bl.
202817 Z DELPHINI—				
	3965.8	12.9 Pt,	3966.8	13.1 Lv.
202946 SZ CYGNI—				
	3955.7	9.2 Pt,	3968.6	9.3 Pt,
	3956.7	9.3 Pt,	3970.7	9.3 Pt,
	3960.6	9.5 Pt,	3971.6	9.2 Pt,
	3962.7	9.6 Pt,	3972.6	9.5 Pt,
	3964.6	9.3 Pt,	3977.6	9.5 Pt,
	3965.8	8.9 Pt,	3979.7	9.5 Pt,
	3966.7	9.0 Pt,	3982.7	9.9 Pt,
	3967.8	9.2 Pt,	3983.6	9.1 Pt.
202954 SR CYGNI—				
	3959.7	12.5 M,	3970.9	13.5 Br.
	3965.8	12.9 Pt,		

VARIABLE STAR OBSERVATIONS, June 20 to July 20, 1924—Continued.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
203226 V VULPECULAE—						
	3965.8	8.8	Pt.			
203429 R MICROSCOPII—						
	3908.2	9.4	Bl,	3949.1	11.7	Bl,
	3917.1	9.7	Bl,	3965.0	12.9	Bl.
	3934 3	10.8	Bl,			
203611 Y DELPHINI—						
	3965.8	11.5	Br,	3968.8	11.4	M.
203816 S DELPHINI—						
	3965.6	9.1	O,	3965.8	8.3	Pt.
203847 V CYGNI—						
	3959.6	11.6	M,	3965.8	11.2	Pt,
	3963.7	11.6	Lv,	3972.8	11.1	Lv.
204016 T DELPHINI—						
	3961.7	13.4	Wf,	3965.8	13.3	Br,
	3965.7	13.5	Wf,	3972.8	13.3	Wf.
204102 V AQUARII—						
	3965.8	8.0	Pt.			
204104 W AQUARII—						
	3909.6	9.4	L,	3936.6	10.3	L.
204215 U CAPRICORNI—						
	3908.2	11.1	Bl,	3934.3	11.7	Bl,
	3917.1	11.0	Bl,	3949.1	12.0	Bl.
	3933.1	11.5	Bl,			
204405 T AQUARII—						
	3940 3	9.5	Ch,	3965.8	7.7	Pt,
	3958.7	7.7	Ca,	3969.7	7.5	Ca,
	3963.2	7.6	Ca,	3978.7	7.5	Ca.
	3964.7	7.5	Ca,			
204846 RZ CYGNI—						
	3961.7	13.9	Wf,	3968.7	13.7	Lv,
	3965.7	14.0	Wf,	3972.8	13.7	Wf.
	3965.8	13.3	Pt,			
204954 S INDI—						
	3908.2	11.6	Bl,	3934.3	13.1	Bl.
205017 X DELPHINI—						
	3966.8	13.8	Lv.			
205923 R VULPECULAE—						
	3965.8	9.8	Pt,	3980.7	9.0	M,
	3965.9	9.7	Br,	3981.8	8.9	Lv.
	3968.8	9.7	Lv,			
210124 V CAPRICORNI—						
	3908.2	11.3	Bl,	3934.3	12.6	Bl.
210221 X CAPRICORNI—						
	3908.3	12.7	Bl,	3949.1	11.5	Bl,
	3934.3	11.5	Bl,	3965.0	11.9	Bl.
210504 RS AQUARII—						
	3936.6	10.0	L,	3965.8	11.2	Pt.
210812 R EQUULEI—						
	3961.8	10.5	Wf,	3965.9	10.6	Br,
	3965.7	10.6	Wf,	3972.8	11.0	Wf.
	3965.8	10.3	Pt,			
210868 T CEPHEI—						
	3909.6	6.7	L,	3964.7	6.4	Ca,
	3916.4	7.3	Ch,	3965.8	6.2	Pt,
	3931.3	6.5	Ch,	3967.6	7.6	O,
	3936.6	6.5	L,	3969.6	6.4	Ca,
	3940.3	6.4	Ch,	3970.7	6.3	Kl,
	3942.7	6.4	Kl,	3974.7	6.2	Js,
	3943.3	6.4	Ch,	3978.6	6.4	Ca,
210868 T CEPHEI—Continued.						
	3958.6	6.3	Ca,	3979.7	6.7	Al,
	3959.6	6.4	Al,	3980.7	6.4	O,
	3962.2	6.4	Ch,	3981.7	6.3	Js,
	3963.7	6.5	Js,	3986.6	6.5	Ca.
211614 X PEGASI—						
	3965.8	9.8	Pt,	3965.8	9.9	Br.
211615 T CAPRICORNI—						
	3908.3	10.1	Bl,	3949.1	12.2	Bl,
	3934.3	11.6	Bl,	3965.0	13.1	Bl.
212030 S MICROSCOPII—						
	3934.3	12.2	Bl,	3965.0	10.0	Bl.
	3949.1	10.2	Bl,			
213244 W CYGNI—						
	3907.3	6.2	Js,	3919.3	6.1	Js.
213678 S CEPHEI—						
	3942 7	9.7	Kl,	3970.7	10.0	Mi,
	3951.9	9.0	Br,	3971.8	10.1	Mi,
	3964.6	9.8	Mi,	3974.8	9.7	Lv,
	3965.8	8.7	Pt,	3977.7	9.7	Kl,
	3967.7	10.0	Mi,	3980.7	10.0	M.
213753 RU CYGNI—						
	3959.6	8.9	M,	3965.8	8.6	Pt.
213843 SS CYGNI—						
	3908.6	9.6	L,	3963.8	8.6	Ca,
	3909.6	9.9	L,	3964.5	8.8	Ro,
	3910.6	10.1	L,	3964.6	9.0	Pt,
	3918.3	[10.9	Ch,	3964.7	8.5	Mi,
	3919.4	12.1	L,	3964.7	8.3	Ly,
	3921.6	11.5	L,	3964.7	8.5	Ca,
	3924.6	10.7	L,	3964.8	8.6	Wf,
	3926.4	11.5	L,	3965.6	8 4	O,
	3927.7	11.7	Kl,	3965.7	8.5	Cy,
	3928.7	11.7	Cy,	3965.7	8.6	Mi,
	3931.3	11.3	Ch,	3965.7	8.8	Wf,
	3932.3	8.4	Ch,	3965.8	9.1	Sg,
	3933.2	8.3	Ch,	3965.8	9.2	Pt,
	3934.3	8.3	Ch,	3965.8	9.0	Br,
	3935.5	9.2	L,	3966.5	9.1	L,
	3935.8	9.5	Br,	3966.6	9.2	Mi,
	3936.4	9.3	L,	3966.7	9.0	Gb,
	3936.7	10.0	Hr,	3966.7	9.4	Pt,
	3936.7	9.9	Em,	3966.8	8.8	Wf,
	3936.7	10.2	Cy,	3966.8	9.4	Lv,
	3937.7	10.0	Cd,	3967.6	9.9	O,
	3937.8	10.0	Br,	3967.6	10.0	Ca,
	3937.8	10.4	Cy,	3967.7	9.0	Ly,
	3938.3	11.0	Ch,	3967.8	9.7	Pt,
	3939.8	11.0	Lv,	3967.8	9.3	Wf,
	3940.6	10.6	L,	3968.6	9.9	Pt,
	3940.7	10.8	Kl,	3968.7	10.0	Mi,
	3941.8	11.1	Cv,	3968.7	9.5	Lv,
	3942.6	10.3	Kl,	3968.8	9.8	M,
	3943.6	11.0	Cd,	3969.6	11.0	Ca,
	3943.8	10.7	Sg,	3969.7	10.4	Mi,
	3944.7	11.5	Cy,	3969.8	10.2	M,
	3944.7	11.6	Hr,	3970.6	11.1	Ca,
	3945.3	11.6	Ch,	3970.6	10.4	Kl,
	3946.8	11.4	Cy,	3970.6	10.9	Mi,
	3948.6	11.1	Ya,	3970.7	10.9	Wf,

VARIABLE STAR OBSERVATIONS, June 20 to July 20, 1924—Continued.

Star	J.D.	Est.Obs.	J.D.	Est.Obs.
213843 SS CYGNI—Continued.				
	3948.8	11.1 Wf,	3970.7	10.6 Pt,
	3949.6	[10.9 Kl,	3970.7	11.0 Cy,
	3950.8	[10.9 Sg,	3970.7	10.8 Br,
	3951.8	11.4 Wf,	3970.8	11.1 Lv,
	3951.8	11.0 Br,	3971.6	11.3 Pt,
	3952.6	11.6 Cd,	3971.7	11.4 Mi,
	3952.8	11.3 Wf,	3971.8	11.0 Br,
	3953.6	11.6 Cd,	3972.6	11.7 Pt,
	3953.6	[10.0 Kl,	3972.7	11.8 Wf,
	3953.7	11.2 Wf,	3972.8	11.7 Lv,
	3955.7	11.8 Pt,	3973.7	12.0 Cv,
	3956.5	11.8 Ro,	3973.8	11.8 Wf,
	3956.7	11.5 Pt,	3974.7	11.7 Cy,
	3956.8	10.6 Sσ,	3974.7	11.8 Wf,
	3957.7	10.9 Lv,	3974.8	11.7 Lv,
	3958.5	9.9 Ro,	3975.5	11.8 Mi,
	3958.7	9.9 Kl,	3975.7	11.8 Wf,
	3958.7	10.2 Ly,	3976.5	11.5 Ro,
	3958.7	10.4 Wf,	3976.6	11.4 Kl,
	3958.7	10.5 Ca,	3976.7	11.7 Cy,
	3959.6	9.4 M,	3977.6	11.5 Kl,
	3959.7	10.0 Ly,	3977.6	11.8 Pt,
	3959.8	9.8 Wf,	3977.8	11.6 Wf,
	3960.6	10.0 Pt,	3978.6	11.6 Ca,
	3960.7	9.4 Wf,	3979.7	11.8 Pt,
	3961.6	9.8 O,	3980.7	12.0 M,
	3961.7	9.4 Lv,	3980.7	[11.0 O,
	3961.8	9.2 Wf,	3981.6	11.8 Al,
	3962.2	8.4 Ch,	3981.7	11.7 Ca,
	3962.6	8.4 O,	3981.7	11.9 Kl,
	3962.6	9.0 Ca,	3982.7	[10.5 Pt,
	3962.7	9.0 Pt,	3983.6	[10.4 Pt,
	3962.7	8.5 Ly,	3984.6	11.7 Kl,
	3963.2	8.3 Ch,	3984.6	[11.0 O,
	3963.6	8.4 O,	3984.7	[11.8 Ya,
	3963.7	8.6 Cy,	3986.6	11.5 Ca,
	3963.8	9.0 Lv,	3992.7	[10.5 Cm.
213937 RV CYGNI—				
	3965.8	6.7 Pt.		
214024 RR PEGASI—				
	3961.8	11.1 Wf,	3965.9	11.4 Br,
	3965.7	11.6 Wf,	3972.8	12.0 Wf.
	3965.8	11.6 Pt,		
214247 R GRUIS—				
	3949.1	13.2 Bl,	3965.0	12.7 Bl.
215605 Y PEGASI—				
	3965.8	8.8 Pt.		
215717 U AQUARII—				
	3965.8	11.8 Pt.		
215934 RT PEGASI—				
	3965.8	11.2 Pt.		
220133a RY PEGASI—				
	3965.8	11.6 Pt.		
220133b RZ PEGASI—				
	3965.8	11.8 Br.		
220412 T PEGASI—				
	3909.6	9.8 L.		
220613 Y PEGASI—				
	3965.9	13.0 Br.		
220714 RS PEGASI—				
	3965.9	13.2 Br.		
222439 S LACERTAE—				
	3909.6	7.8 L,	3965.8	10.9 Pt,
	3930.6	8.9 L,	3970.9	11.2 Br.
222867 R INDI—				
	3908.2	10.8 Bl,	3934.3	13.1 Bl.
223841 R LACERTAE—				
	3907.9	13.7 Br,	3935.5	13.7 L.
230110 R PEGASI—				
	3962.7	10.0 Ca,	3977.6	10.6 Cd,
	3965.8	9.8 Pt,	3978.7	10.6 Ca.
	3968.8	9.8 M.		
230759 V CASSIOPEIAE—				
	3946.8	10.7 Cy,	3969.9	9.3 Mi,
	3962.7	9.3 Ca,	3974.7	8.5 Cy,
	3962.8	9.5 Mi,	3975.7	8.8 Mi,
	3964.9	9.4 Mi,	3976.5	9.0 Ro,
	3965.8	8.8 Pt,	3981.7	7.9 Ca.
231425 W PEGASI—				
	3909.6	11.9 L,	3968.8	11.8 M.
231508 S PEGASI—				
	3965.8	11.2 Pt.		
232848 Z ANDROMEDAE—				
	3965.8	9.6 Pt,	3968.8	9.9 M.
233335 ST ANDROMEDAE—				
	3965.8	10.5 Pt,	3968.8	10.8 M.
	3967.7	10.7 Ca,		
233815 R AQUARII—				
	3962.8	8.8 Ca,	3970.8	9.1 Ca,
	3965.8	9.0 Pt,	3978.8	9.4 Ca.
233956 Z CASSIOPEIAE—				
	3961.8	11.2 Wf,	3970.9	10.0 Br,
	3965.7	10.6 Wf,	3972.8	10.1 Wf.
235209 V CETI—				
	3908.3	11.9 Bl,	3965.3	9.5 Bl.
	3934.3	10.0 Bl,		
235350 R CASSIOPEIAE—				
	3946.8	8.8 Cy,	3976.7	9.6 Cy,
	3962.7	8.6 Ca,	3978.7	9.0 Ca,
	3968.8	9.2 M,	3984.6	9.7 O.
	3970.9	9.0 Br,		
235855 Y CASSIOPEIAE—				
	3970.9	11.0 Br.		
235939 SV ANDROMEDAE—				
	3965.8	11.6 Pt,	3970.9	11.9 Br.

Total Observations: 2,238. Stars Observed: 314. Observers: 30.

The following observers contributed to this report: Messrs. Allen "Al", Baldwin "Bl", Bouton "B", Brocchi "Br", Carr "Ca", Chandler "Cd", Chandra

"Ch", Chisolm "Cm", Cilley "Cy", Elmer "Em", Gaebler "Gb", Henry "Hr", Jones "Js", Kanda "Kd", Kleis "Kl", Lacchini "L", Mrs. Leavens "Ln", Leavenworth "Lv", Lefever "Lf", Mrs. Lytle "Ly", McAteer "M", Mitchell "Mi", Olcott "O", Peltier "Pt", Rhorer "Ro", Schüller "Sl", Skaggs "Sg", Smith "Sm", Waterfield "Wf", and Yalden "Ya".

HOWARD O. EATON, Recording Secretary.

COMMUNICATIONS.

Observation of the last phase of the transit of Mercury at the Observatory of the Ebro, May 8.—Clear sky; conditions for observation bad because of the small altitude of the sun above the horizon and the prevailing north wind; solar rims very indistinct; the image of Mercury on the disc rather clear.

$5^h\ 33^m\ 35^s$. (Time M. C. of Gr.) First photograph, moments previous to the second internal contact. The image of Mercury appears near the limb.

$5^h\ 35^m\ 29^s$. Second internal contact observed under average conditions because of the instability of the solar contours.

$5^h\ 35^m\ 33^s$. Second photograph four seconds after having visually noted the second internal contact; the image appears as a notch in the limb.

$5^h\ 38^m\ 01^s$. Time of third photograph. The traces of the image disappear in the irregularities of the limb, making the last contact rather uncertain.

The visual observation was done by the undersigned with the direct equatorial of the observatory, diameter 160 mm, and 2.10 meters focal length, using a Herschel helioscopic ocular of 40 diameters. The photographs were obtained at the opportune moments by Father Joaquin Pericas.

LUIS RODÉS, S. J.

Bright Meteors. — The following is a list of fine meteors and fireballs observed on the nights of Friday, July 25, and Saturday, July 26, 1924.

July 25, at 9:05, Eastern Daylight Saving Time, a fine meteor of about —2.0 magnitude appeared to the east of α Ophiuchi and traveled swiftly across the sky to a point about 6° west of Alya in Serpens.

9:09. A first magnitude meteor appeared above and to the west of Vega, and after traveling about 6°, disappeared, and appeared again at a point 7° further on, and after traveling 10° more disappeared completely. This meteor was white and traveled slowly.

10:35. A beautiful red meteor of about magnitude —2.0 appeared near β Cygni, traveled eastward through Delphinus, and disappeared in the region of Equuleus. After it had traveled about 7° a haziness appeared on each side of the meteor, and continued during the rest of the meteor's visibility. The meteor was over 30° long, and traveled rather swiftly.

10:47. A beautiful fireball was seen to start at a point 4° southwest of Vega, near a point where No. 2 of this list emanated, and traveled slowly in a northwesterly direction for 18°. As it neared the finish of its path it spread out in a glorious pear-shaped figure, of a yellowish hue, and considerably brighter than Venus at her very best. No sounds were heard. The color seemed to change from white to yellow, and at diffusing had the intensity of an electric bulb. This fireball appeared near the zenith.

July 26, 9:15. A fireball appeared in the zenith inside the rough square

PLATE XXI.

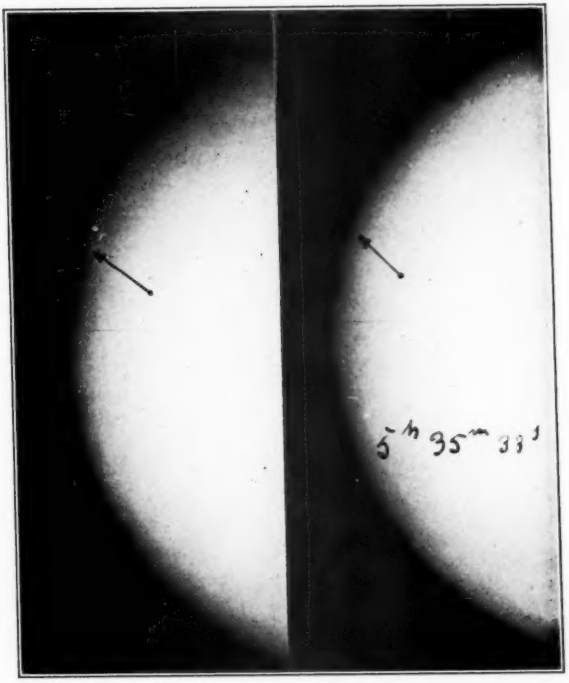


Fig. 1 Fig. 2

PHOTOGRAPHS OF MERCURY NEAR END OF TRANSIT, MAY 7-8, 1924.

Taken at the Observatory of the Ebro, Tortosa, Spain.

formed by ϵ, ζ, η, π of Hercules, and after traveling 10° to the southwest, it began to diffuse into a sort of oval-shaped figure. It was lost among the trees at this stage of its appearance, and was gone before I had a chance to get around to it. It was of the first magnitude, and was of a yellowish tint.

9:46. A beautiful red meteor of 0 magnitude appeared above θ Draconis and traveled swiftly to a point 4° east of β Bootis. It left a magnificent trail which lasted about 2.5 seconds.

9:51. A yellow, stationary meteor flashed into view inside the triangle in Draco formed by ϕ, χ, ψ. It was of magnitude 1 and lasted about .3 of a second. It was of a yellowish color.

10:20. A white meteor started near μ Aquilae, and very swiftly traveled up to the parallelogram figure in Hercules. The meteor was of magnitude 1, and disappeared and reappeared four times before finally passing from view.

10:32. A bright yellow meteor was seen to start near η Pegasi, and traveled 5° south swiftly.

10:47. A bright yellow meteor of 0 magnitude started above θ Ophiuchi and traveled 6° in the direction of Antares.

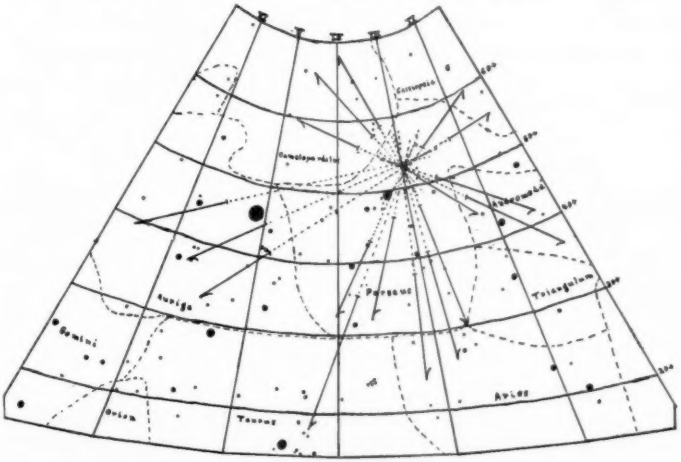
SAMUEL CRAMER.

49 Arlington St., Worcester, Mass.

The Perseids, August 11.—The return of the Perseids this year was not marked by any especially brilliant display, though they were probably about up to average in numbers. No large meteors were observed here, the brightest being one of the 0.5 magnitude.

Following are the results of three nights' observing:

Date	Rate	Plotted Radiant		Total Number
		α	δ	
		h m s	° ′	
August 2.8	18	1 14 30	52 32	27
10.8	12	2 31 24	55 48	14
11.8	23	2 59 12	53 07	25



PERSEIDS, AUGUST 11, 1924.

The rate given is for *observed* meteors only and since one minute, on the average, was consumed in plotting a path and writing down data the actual rate for the stream would be more than twice the value given.

The accompanying map gives the radiant for August 11, the date of maximum.

STERLING BUNCH.

No. Ft. Worth, Texas, Box 81, Stockyards Station.

Occultation of Venus. — The conditions here on the morning of August 26 for viewing the occultation of Venus by the moon were excellent. A recent rain had cleared the atmosphere of haze and smoke, and all day, Aug. 25, the purple Cascade range with the towering snow peaks of Hood, Adams and St. Helens stood out against a cloudless sky as distinctly as an etching.

The unfavorable circumstance that the occultation was scheduled to occur at a very low altitude was largely offset by the fact that my house is situated on Council Crest, an eminence 900 feet above the city.

At 1:49 A. M., Venus being nowhere in sight, it was at once evident that the first stage of the "osculation," as my wife facetiously termed it, was past, and that immersion had occurred below the serrated sky-line of mountains.

As the moon rose higher, the dark portion within the crescent showed distinctly with a faint copper color, and the telescope plainly revealed the darker areas of the "seas."

After about a half hour of close watching, a faint glow appeared at the dark limb, about 45 degrees from the lower cusp, and at $2^h\ 26^m\ 20^s$ A. M. the bright horn of Venus appeared. The beautiful silvery planet crept slowly into view like a timid little girl peering around her mother at the company, and then shyly coming out to greet them. Words can not do justice to the rare beauty of this celestial phenomenon. There was something solemn and spiritual, too, in the sight of these heavenly bodies moving in obedience to the law of their Maker.

I should judge that the emergence occupied about forty-five seconds from the first re-appearance of Venus until the planet cleared the moon's limb. I was so captivated by the charm and glory of the spectacle that I forgot to catch the time.

I used a 2⅜-inch telescope with an eyepiece giving a magnification of 54.

ROBERT E. MILLARD.

1014 Council Crest Drive, Portland, Oregon.

GENERAL NOTES

Professor S. A. Mitchell, director of the Leander-McCormick Observatory, University, Virginia, has spent two months this summer at the Mt. Wilson Observatory engaged in getting out a second edition of "Eclipses of the Sun," the first edition being already exhausted.

Mr. Charles L. Early, of Sac City, Iowa, a constant reader of POPULAR ASTRONOMY and an occasional contributor to the magazine, died suddenly at his home on August 5, 1924. Mr. Early was greatly interested in astronomy and had a very good observatory in connection with his residence. About forty years

ago he invented the principle of the adding machine, and in recent years devised a sun clock and locometer, an invention which enables a person with the aid of a chronometer to determine the latitude and longitude of a place on the earth's surface without mathematical calculations of any kind.

Mr. L. R. Wylie, instructor in Astronomy at the Dearborn Observatory, Northwestern University, Evanston, Ill., has accepted an appointment in the Observatory at Ohio Wesleyan University.

Miss Laura E. Hill, of the Dearborn Observatory, goes to Vassar for the coming year.

Miss Vera M. Gushee has accepted an appointment at the Dearborn Observatory for the coming year.

Prof. A. S. Eddington, professor of Astronomy and Experimental Philosophy, University of Cambridge, England, will give two courses of lectures in the department of Physics of the University of California, beginning about September 24, 1924, and continuing to the end of the semester. The first will be an advanced course on the Mathematical Theory of Relativity, three hours per week. The second will be on Problems of Sidereal Astronomy, a discussion of modern research as to the movements, constitution and evolution, of the stars and nebulae, two hours per week.

Professor Eddington will also offer a non-mathematical course of six lectures on Relativity, intended for science students having some familiarity with scientific arguments and modes of thought. The titles of these lectures are: 1. The Need for a Revolution in Scientific Thought. 2. Time and the Fourth Dimension. 3. The Special Theory. 4. The Man in the Elevator. 5. Curvature of Space. 6. Results and Objections. (*Pub. Ast. Soc. of the Pacific*, Aug. 1924.)

Professor S. A. Mitchell, director of the Leander McCormick Observatory, University of Virginia, has received the degree of doctor of laws from Queen's University, Ontario, on account of his "international eminence as an astronomer."

Osservatorio Collegio Romano. — The old observatory of Secchi at the Collegio Romano in Rome has been closed. The library and instruments have been distributed among various observatories of the government. (*Pub. A. S. P.* August, 1924.)

Dr. Adriaan van Maanen has been elected a correspondent of the Royal Academy of Sciences at Amsterdam. (*Pub. A. S. P.* August, 1924.)

Miss Hazel Burton, a graduate of Mt. Holyoke College with the class of 1924, has been appointed assistant in the Lick Observatory, from August 1, 1924. (*Pub. A. S. P.* August, 1924.)

Dr. Hamilton M. Jeffers has been appointed assistant astronomer at the Lick Observatory from August 1, 1924. (*Pub. A. S. P.* August, 1924.)

Mars. — During the past few weeks the planet Mars has been unusually near the earth, and has shone with a very brilliant ruddy light in the southern sky. So much has been said about the planet by the reporters for the daily newspapers, that some of our readers may be looking for announcements of remarkable discoveries. Frankly, however, we may say that the altitude of Mars is so low for observers in the Northern Hemisphere, that very little may be expected here this year in the way of valuable observations of the planet. No reports at all have yet been received of this year's study of the planet. Possibly later we may have word of something worth while from the Lowell and Mount Wilson observatories.

In the Southern Hemisphere the conditions are different. Mars there crosses the meridian at a high altitude and observers there may be able to discover something new in regard to the planet, certainly to add to the data which we already have concerning the visible markings and their changes.

At Northfield there were five successive clear nights during the last week in August when Mars was nearest the earth, but on only one of them was the seeing fine enough to afford momentary glimpses of the narrow markings which have been called "canals." In no case could these glimpses be held long enough to locate the "canals" definitely enough to identify them.

The white south polar cap was always distinctly seen and grew smaller from night to night.

Sunspot Activity. — Mr. F. E. Seagrave writes us that a large sunspot group developed during the last days of August. He says:

"The most remarkable thing about this group is its rapid growth and development. On August 27 my notebook states that there is not a spot on the sun's disc visible in a 4-inch telescope. On August 28 the spot marked A (sketch not reproduced) was just coming into view, and my notebook mentions a very small cluster or swarm of spots (apparently mere pin points) forming a little north and preceding this spot. On August 28 this group had grown and developed so that it was visible to the naked eye. On August 30 and today (August 31) it is easily seen with the naked eye as one spot. A few of the small spots between the two larger ones that were seen yesterday have filled up."

On September 3, at Northfield, the spot was not visible with the naked eye, nor with a 1-inch telescope of 3-inch focus. The sun was not examined with larger instruments.

Stockholm Observatory Publication. — Volume 10, Number 12 of the Publications of the Observatory of Stockholm, Sweden, contain a catalogue of 1210 stars for the epoch 1875.0, observed with the meridian circle during the period 1873-1900. The stars are between 45° and 90° of north declination, and are mostly stars of the British Association Catalogue for 1850.0. In addition to the usual data given in such catalogues, the spectral type of the star is appended, where it is known.